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June 12, 2006

Mr. Kenneth Bardo
Project Manager
United States Environmental Protection Agency
Region 5
77 West Jackson Boulevard
Chicago, IL 60604-3590

Re: Revised Evaluation of Supplemental Alternative Corrective Measure Remediation
Former World Kitchen, Inc. Massillon, Ohio Facility
U.S. EPA ID No. OHD 045-205-424

Dear Mr. Bardo:

On behalf of Wyeth and World Kitchen, Inc. (WKI), Weston Solutions, Inc. (WESTON®) is providing to the United States Environmental Protection Agency (U.S. EPA) a revised evaluation of seven supplemental alternative corrective measures for the "West" (i.e., Area 1-West and Area 2-West) and "East" (i.e., Area 3–East) Areas of the former World Kitchen, Inc. Massillon, Ohio facility. The original evaluation was provided to the U.S. EPA in a letter report dated 4 May 2006. This evaluation was revised based upon further discussion with the U.S. EPA on 15 May 2006 and has been performed in accordance with the requirements of the Administrative Order on Consent (Consent Order) between U.S. EPA, WKI, and Wyeth set forth in Attachment 2, Section 4.1b, which allows Wyeth to submit an evaluation of engineering controls as an alternative corrective measure to supplement the original site corrective measure.

The original evaluation was based on addressing the soil performance standards for protecting groundwater at the facility, which were previously established by the Consent Order (Table 1 of Attachment 1 to the Consent Order). Based upon the fact that there is an existing groundwater pump and treat system in place that will continue to operate and WESTON's further discussion with the U.S. EPA, the evaluation was revised to include supplemental alternatives that address the industrial soil performance standards for human exposure at the facility, which also were previously established in the Consent Order (Table 2 of Attachment 1 to the Consent Order). As a result, the areal extent of the supplemental Alternative 2: Excavation and Disposal (hereinafter referred to as Alternative 2A) and supplemental Alternative 3: Thermal Treatment – Electrical Resistance Heating (ERH) (hereinafter referred to as Alternative 3A) was reduced for the revised evaluation as presented in supplemental Alternative 2B: Excavation and Disposal - Industrial Soil Performance Standards for Human Exposure and supplemental Alternative 3B: Thermal Treatment (ERH) - Industrial Soil Performance Standards for Human Exposure. Additionally, this revised evaluation includes supplemental Alternative 2C: Excavation and Disposal - Industrial Soil Performance Standards for Human Exposure to 2 feet below ground surface (bgs).

As previously discussed in detail in a January 30, 2006 Letter Report to you, the soil vapor extraction (SVE) and air sparging systems at the former WKI facility have been in operation for approximately 2½ years and have removed more than 19,293 pounds of volatile organic compounds (VOC). Additionally, the WKI facility has met four of the five RCRA Corrective Action - Environmental Indicator (EI) Milestones that are listed below:

	Environmental Indicator	**Date Completed**
CA400	Remedy Selection Completed	8/6/02
CA550	Certification of Remedy Completion	9/12/03
CA725	Current Human Exposures Under Control	10/10/01
CA750	Migration of Contaminated Groundwater Under Control	12/19/00
CA999	Corrective Action Completed	----

As noted in recent quarterly progress reports, the VOC concentrations in the extracted air from all of the treatment areas: North, East, and West, have diminished significantly from initial startup concentrations and are now at asymptotic levels, meaning that equilibrium has been reached, and only significantly low and non-detectable concentrations of site-specific target compounds remain in the extracted soil vapor. Continued operation of the East and West systems is providing no benefit and does not result in measurable mass removal. Based on this information, Wyeth requested in the January 30, 2006 Letter Report that the East and West SVE systems be closed down and that engineering controls be put in place to supplement the original site corrective measure. Wyeth proposed that the East and West SVE areas be paved (capped) to prevent direct contact and minimize infiltration of precipitation. During a conference call with you on February 14, 2006, U.S. EPA requested that additional alternative corrective measures be evaluated for the East and West Areas and provided two examples: excavation of impacted soils and ERH. As noted, the original evaluation was provided to the U.S. EPA in a letter report dated 4 May 2006. This evaluation was revised based upon further discussion with the U.S. EPA on 15 May 2006 and is provided in this letter report. The following is a description of the supplemental alternative corrective measures followed by an evaluation and comparison of the alternatives presented in tabular format and selection for implementation based on this evaluation. The No Further Action alternative (Alternative 1) is provided for baseline comparison.

Under all scenarios, the groundwater pump and treat system will continue to operate and migration of contaminated groundwater (CA750) will remain under control.

Description of Alternative 1: No Further Action

In this alternative, no further corrective action would be conducted at the East and West Areas in addition to the SVE/air sparge corrective measures completed in those areas. The East and West Area SVE and sparge systems would be decommissioned. Specifically, the ten SVE vents in the West Area and seven SVE vents and four air sparging wells in the East Area would be removed.

Description of Alternative 2A: Excavation and Disposal – Soil Performance Standards for Protecting Groundwater

This alternative addresses the soil performance standards for protection of groundwater at the facility. In this alternative, soils with concentrations greater than the soil performance standards for protection of groundwater presented in Attachment 1, Table 1 of the Consent Order, would be excavated and transported off-site for disposal in a Resource Conservation and Recovery Act (RCRA)-permitted hazardous waste landfill (Subtitle C landfill). Excavated areas would be backfilled with clean fill and revegetated.

In the East Area, an area approximately 20 feet long by 20 feet wide by 6 feet deep would be excavated (90 cy) (See Figure 1). In the West Area, two separate areas would be excavated (See Figure 2). The dimensions of the areas are the following: Area 1-West, approximately 120 feet long x 20 feet wide x 11 feet deep (978 cy) (extending from approximately SB-07-00 to SB-05-91) and Area 2-West, approximately 250 feet long x 20 feet wide x 9 feet deep (1667 cy) (extending from approximately SB-15-00 to SB-18-00). The excavation would abut the west side of the building and the railroad embankment along the property boundary. Due to the depth of the excavation, shoring would be required to prevent soil sloughing, building damage, and undermining the railroad bed. There is an underground sewer pipe that runs parallel to the building along the length of the area. The excavation and shoring activity must avoid damaging this sewer pipeline. Due to the age of the facility and the dated utility drawing, it is uncertain if there are any other obstructions in the subsurface in this area. As part of the excavation effort, all ten SVE vents in the West Area and seven SVE vents and four air sparging wells in the East Area would have to be removed. Additionally, water from storm events and perched water from surrounding areas would be anticipated to infiltrate or flow into the open excavation. It would be necessary to install a pump into the excavation to remove this water and keep the excavation dry until it is backfilled. The water would have to be sent through the existing on-site air stripper for treatment before discharge or transported off-site for treatment and disposal. The excavated area would be backfilled with clean fill and revegetated.
The following assumptions were used to evaluate this alternative:

- The subject areas would be excavated and the soils transported off-site for treatment and disposal in a Subtitle C landfill. Some soils in the West Area contain trichloroethylene (TCE) concentrations greater than 10 times its Universal Treatment Standard (UTS) of 6 mg/kg. These soils would require additional treatment before placement in the RCRA landfill.

- No additional drying or dewatering would be required for soils to meet the paint filter test for land disposal.

- Extensive shoring would be required in the West Area to keep the excavation open and prevent structural damage to the building and railroad bed. The East Area excavation could include shoring to limit the overexcavation which would occur from cutting back the sideslopes of the excavation to reach the required six foot depth.

- Water from the excavation would be treated in the on-site air stripper.

- Excavation in these areas would not affect plant vehicular traffic.

- The area would be backfilled with clean fill and revegetated.

Description of Alternative 2B: Excavation and Disposal – Industrial Soil Performance Standards for Human Exposure

This alternative addresses the industrial soil performance standards for human exposure to contaminants at the facility. In this alternative, soils with concentrations greater than the industrial soil performance standards presented in Attachment 1, Table 2 of the Consent Order, would be excavated and transported off-site for disposal in a RCRA-permitted hazardous waste landfill (Subtitle C landfill). Excavated areas would be backfilled with clean fill and revegetated.

In the East Area, an area approximately 20 feet long by 20 feet wide by 6 feet deep would be excavated (90 cy) (See Figure 1). In the West Area, two separate areas would be excavated (See Figure 2). The dimensions of the areas are the following: Area 1-West, approximately 60 feet long x 20 feet wide x 8.5 feet deep (378 cy) (extending from approximately CB-09-05 to CB-11-05) and Area 2-West, approximately 80 feet long x 20 feet wide x 7 feet deep (415 cy) (extending from approximately CB-06-05 to CB-08-05). As in Alternative 2A, the excavation would abut the west side of the building and the railroad embankment along the property boundary. Due to the depth of the excavation, shoring would be required to prevent soil sloughing, building damage, and undermining the railroad bed. There is an underground sewer pipe that runs parallel to the building along the length of the area. The excavation and shoring activity must avoid damaging this sewer pipeline. Due to the age of the facility and the dated utility drawing, it is uncertain if there are any other obstructions in the subsurface in this area.

As part of the excavation effort, all ten SVE vents in the West Area and seven SVE vents and four air sparging wells in the East Area would have to be removed. Additionally, water from storm events and perched water from surrounding areas would be anticipated to infiltrate or flow into the open excavation. It would be necessary to install a pump into the excavation to remove this water and keep the excavation dry until it is backfilled. The water would have to be sent through the existing on-site air stripper for treatment before discharge or transported off-site for treatment and disposal. The excavated area would be backfilled with clean fill and revegetated.

The following assumptions were used to evaluate this alternative:

- The subject areas would be excavated and the soils transported off-site for treatment and disposal in a Subtitle C landfill. Some soils in the West Area contain TCE concentrations greater than 10 times its UTS of 6 mg/kg. These soils would require additional treatment before placement in the RCRA landfill.

- No additional drying or dewatering would be required for soils to meet the paint filter test for land disposal.

- Extensive shoring would be required in the West Area to keep the excavation open and prevent structural damage to the building and railroad bed. The East Area excavation could include shoring to limit the overexcavation which would occur from cutting back the sideslopes of the excavation to reach the required six foot depth.

- Water from the excavation would be treated in the on-site air stripper.

- Excavation in these areas would not affect plant vehicular traffic.

- The area would be backfilled with clean fill and revegetated.

Description of Alternative 2C: Excavation and Disposal - Industrial Soil Performance Standards for Human Exposure to 2 Feet bgs

This alternative addresses the industrial soil performance standards for human exposure to contaminants at the facility. In this alternative, soils to a depth of 2 feet bgs with concentrations greater than the industrial soil performance standards presented in Attachment 1, Table 2 of the Consent Order, would be excavated and transported off-site for disposal in a RCRA-permitted hazardous waste landfill (Subtitle C landfill). Excavated areas would be backfilled with clean fill and revegetated.

The excavation depth of 2 feet for soils with concentrations greater than the industrial soil performance standards for human exposure was selected because removal of these soils eliminates the direct contact pathway for an outdoor worker at the facility. According to U.S. EPA guidance[1], "The activities for this receptor (e.g., moderate digging, landscaping) typically involve on-site exposures to surface and shallow subsurface soils (at depths of zero to two feet)."

In the East Area, an area approximately 20 feet long by 20 feet wide by 2 feet deep would be excavated (30 cy) (See Figure 1). In the West Area, two separate areas would be excavated (See Figure 2). The dimensions of the areas are the following: Area 1-West, approximately 60 feet long x 20 feet wide x 2 feet deep (89 cy) (extending from approximately CB-09-05 to CB-11-05) and Area 2-West, approximately 80 feet long x 20 feet wide x 2 feet deep (119 cy) (extending from approximately CB-06-05 to CB-08-05). The excavation would abut the west side of the building and the railroad embankment along the property boundary. Due to the shallow depth of the excavation, shoring would not be required and the excavation would be located above any underground piping such as the sewer, which runs parallel to the building along the length of the area. As part of the excavation effort, all ten SVE vents in the West Area and seven SVE vents and four air sparging wells in the East Area would have to be removed. Since the excavation is shallow and does not require shoring, the excavation can be performed efficiently in a timely manner such that water accumulation would not be an issue. The excavated area would be backfilled with clean fill and revegetated. Additionally, a deed restriction preventing the excavation and disturbance of impacted subsurface soils (greater than 2 feet bgs) in the East and West Areas would be retained.

The following assumptions were used to evaluate this alternative:

- The subject areas would be excavated to a depth of 2 feet bgs and the soils transported off-site for treatment and disposal in a Subtitle C landfill. Some soils excavated from the West Area may contain TCE concentrations greater than 10 times its UTS of 6 mg/kg. These soils would require additional treatment before placement in the RCRA landfill.

1 *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites*, U.S. EPA, OSWER 9355.4-24, December 2002.

- No additional drying or dewatering would be required for soils to meet the paint filter test for land disposal.

- Shoring would not be required.

- No significant water accumulation would occur.

- Excavation in these areas would not affect plant vehicular traffic.

- The area would be backfilled with clean fill and revegetated.

Description of Alternative 3A: Thermal Treatment – Electrical Resistance Heating (ERH) – Soil Performance Standards for Protecting Groundwater

This alternative addresses the soil performance standards for protection of groundwater at the facility and would be implemented in the same area described in Alternative 2A. Electrical Resistance Heating (ERH) is an in situ thermal technology that uses electrical resistance heating and steam stripping to remove volatile and semivolatile organic compounds from the subsurface. The technology applies electricity into the ground through electrodes. The soil temperature is raised to the boiling point of water and the volatile compounds transition to the vapor phase and are captured by a vapor recovery system.

Approximately 53 electrodes would be installed into the subsurface and would extend from 1 to 11 feet bgs. The electrodes would be located approximately 13 feet apart. Although 53 vapor recovery wells would be co-located in the same borehole with the electrodes, an additional 25 wells would be installed for vapor recovery. Five temperature monitoring points, each with four sensors also would be installed to monitor the subsurface heating. An insulating surface cap would need to be installed to prevent vapors and heat from being released to the ambient air. It is estimated that the treatment system would operate for approximately 98-147 days and would require 783,000 to 849,000 kW-hr of power.

At the end of the treatment session, confirmatory soil sampling would be required to determine effectiveness. If the treatment goals are not achieved, the system would be operated for an additional length of time. Upon final treatment, all vents and wells would be abandoned in place.

A vapor recovery and treatment system (i.e., activated carbon) would be required. Approximately 1 gallon per minute (gpm) of condensate would be produced and require collection for treatment/disposal. It is also likely that shallow groundwater would be pulled by vacuum into the 78 vapor recovery wells. This was a major operational limitation with the SVE system.

The following assumptions were used to evaluate this alternative:

- The drill cuttings from the soil borings (approximately 25 cy) would be transported off-site for treatment and disposal in a Subtitle C landfill. Some soils in the West Area contain TCE concentrations greater than 10 times its UTS of 6 mg/kg. These soils would require additional treatment before placement in the RCRA landfill.

- Treatment and heating would not translocate the VOCs out of the treatment area or deeper in groundwater.

- High voltage power would be available on-site.

- Sufficient air flow would be attained to collect vapors in the tight, wet soils. The existing SVE system did not achieve extensive air flow and the 13-foot spacing may not be enough.

- Significant short-circuiting of the resistance heating in the soils or heat loss at the soil surface would not occur.

- Surface coverage and restricted access in these areas would not affect plant vehicle access.

- Unknown underground obstructions which may exist in the areas would not negatively impact installation of the treatment system or soil treatment.

Description of Alternative 3B: Thermal Treatment – Electrical Resistance Heating (ERH) – Industrial Soil Performance Standards for Human Exposure

This alternative addresses the industrial soil performance standards for human exposure to contaminants at the facility and would be implemented in the same area described in Alternative 2B. Approximately 26 electrodes would be installed into the subsurface and would extend from 1 to 10 feet below bgs. The electrodes would be located approximately 11 feet apart. Although 26 vapor recovery wells would be co-located in the same borehole with the electrodes, an additional 9 wells would be installed for vapor recovery. Three temperature monitoring points, each with three sensors also would be installed to monitor the subsurface heating. An insulating surface cap would need to be installed to prevent vapors and heat from being released to the ambient air. It is estimated that the treatment system would operate for approximately 52-85 days and would require 232,000 to 257,000 kW-hr of power.

At the end of the treatment session, confirmatory soil sampling would be required to determine effectiveness. If the treatment goals are not achieved, the system would be operated for an additional length of time. Upon final treatment, all vents and wells would be abandoned in place.

A vapor recovery and treatment system (i.e., activated carbon) would be required. Approximately 1 gpm of condensate would be produced and require collection for treatment/disposal. It is also likely that shallow groundwater would be pulled by vacuum into the 35 vapor recovery wells. This was a major operational limitation with the SVE system.

The following assumptions were used to evaluate this alternative:

- The drill cuttings from the soil borings (approximately 9 cy) would be transported off-site for treatment and disposal in a Subtitle C landfill. Some soils in the West Area contain TCE concentrations greater than 10 times its UTS of 6 mg/kg. These soils would require additional treatment before placement in the RCRA landfill.

- Treatment and heating would not translocate the VOCs out of the treatment area or deeper in groundwater.

- High voltage power would be available on-site.

- Sufficient air flow would be attained to collect vapors in the tight, wet soils. The existing SVE system did not achieve extensive air flow and the 11-foot spacing may not be enough.

- Significant short-circuiting of the resistance heating in the soils or heat loss at the soil surface would not occur.

- Surface coverage and restricted access in these areas would not affect plant vehicle access.

- Unknown underground obstructions which may exist in the areas would not negatively impact installation of the treatment system or soil treatment.

Description of Alternative 4: Paving/Capping

This alternative addresses the soil performance standards for protection of groundwater and industrial soil performance standards for human exposure to contaminants at the facility. This alternative consists of paving/capping both the East and West areas with asphalt. It would be designed to prevent direct contact with underlying soils and to minimize infiltration to these soils. Specifically, soils containing concentrations exceeding the soil performance standards for protection of groundwater (approximately 9,000 sq ft of area) would be paved. A compacted gravel and stone base would be placed first as the sub-base followed by an asphalt paving layer. All SVE vents and air sparging wells in both the East and West Areas would be closed in place. In the West Area, the pavement would be sloped to drain away from the building and toward the existing storm drain inlets to the extent possible. An Operation and Maintenance (O&M) Plan would be prepared to include inspections and maintenance to assure integrity of the asphalt cap. Additionally, the deed restriction preventing excavation and disturbance of impacted subsurface soils in the East and West Areas would be retained.

The following assumptions were used to evaluate this alternative:

- The top 3 inches of soil and grass would be removed before placement of the stone sub-base and paving. The excavated topsoil would be sampled to determine the appropriate soil profiling for disposal.

- Additional storm water drainage piping and inlets would not be required.

Table 1 provides a summary and comparison evaluation of these seven alternative corrective measures for supplementing the SVE corrective measure completed in the East and West Areas at the former WKI facility.

Selected Supplemental Alternative Corrective Measure

Based on the evaluation and comparison of the seven alternative corrective measures presented in Table 1, WESTON selects implementation of Alternative 4: Capping/Paving. When compared to Alternative 1: No Further Action, Alternative 4: Capping/Paving includes additional measures to provide appropriate protection of human health and the environment. It provides the same level of environmental protection as Alternatives 2A, 2B, 2C, 3A, and 3B with less short-term impacts and implementation uncertainties. Alternative 4: Capping/Paving uses a physical barrier to be protective of human health and the environment. This barrier covers soils with concentration of constituents greater than the soil performance standards for the protection of groundwater. It prevents direct contact human exposure with underlying soils and minimizes infiltration to the groundwater. A deed restriction notice and its associated O&M activities and schedule will be put in place to maintain the long-term integrity of the cap and prevent subsurface infiltration. This alternative, combined with continued operation of the groundwater remediation system and deed restriction measures/O&M activities, will ensure protection of human health and the environment. It will be readily implemented with little disruption to site activities and negligible generation of waste.

While Alternatives 2A, 2B, 2C, 3A, and 3B are also protective of human health and the environment, there were a number of factors that precluded these alternatives from being selected for implementation. With respect to Alternative 2A: Excavation and Disposal – Soil Performance Standards for Protecting Groundwater and Alternative 2B: Excavation and Disposal – Industrial Soil Performance Standards for Human Exposure, the extensive soil disturbance (to a depth of 11 and 8.5 feet bgs, respectively) in an area of restricted space with underground piping (possibly some unknown structures), there are numerous concerns for the West Area with compromising the building structure and the nearby railroad bed. Extensive shoring would be necessary to prevent damage to adjacent structures and minimize overexcavation. The short-term impact from the earthmoving activities would result in significant volatilization of VOCs and generation of dust, which would require control.

It is important to note that Alternative 2C: Excavation and Disposal – Industrial Soil Performance Standards for Human Exposure to 2 Feet bgs does not require the intensive measures such as shoring and water management, or exhibit the same potential to encounter subsurface structures as in Alternatives 2A and 2B due to the shallow excavation depth in this alternative. Since less soils would be disturbed, there would be a lower short-term impact from earthmoving compared to Alternatives 2A and 2B. The shallow excavation depth also allows for smaller equipment to be used in restricted space areas. Additionally, removal of the surface soils and replacement with clean fill would eliminate the human exposure pathway.

Alternative 4 was selected over Alternative 2C because short-term impacts are slightly lower in Alternative 4 (i.e., the top 3 inches of soil are excavated in Alternative 4 versus 2 feet in Alternative 2C). While both alternatives eliminate the direct contact human exposure pathway, the asphalt cap covers soils with constituent concentrations greater than the soil performance standards for the protection of groundwater (an area of approximately 9,000 sf), whereas Alternative 2C specifically addresses soils with constituent concentrations greater than the industrial soil performance standards for human exposure (an area of approximately 3,200 sf). Thus, Alternative 4 provides the additional protection for the soil to groundwater pathway. Additionally, the site owner is amenable to Alternative 2C as it involves minimal disruption to plant operations and allows owner access to the west side of the building.

With respect to Alternative 3A: Thermal Treatment - Electrical Resistance Heating (ERH) – Soil Performance Standards for Protecting Groundwater and Alternative 3B: Thermal Treatment – ERH – Industrial Soil Performance Standards for Human Exposure, extensive activities would be conducted to address this remaining residual VOC mass, which could be addressed by less invasive means and result in fewer short-term impacts. Although Alternative 3B involves a smaller volume of soils to address, the effort is still extensive when compared to Alternative 3A (and ultimately Alternative 4). To implement this technology, approximately 35 (Alt. 3B) or 80 (Alt. 3A) borings would need to be drilled to install not only the electrodes (approximately 26 for Alt. 3B or 53 for Alt. 3A) for electrical resistance heating, but an additional 9 (Alt. 3B) or 25

(Alt. 3A) vents for soil vapor recovery. Since the residual VOCs are located in shallow soils, extra caution would need to be taken to prevent air releases from the surface and a cap would need to be placed over the area to be treated. Even so, there is some concern that some of the vapors could translocate out of the treatment area and not be entirely retrieved by the vapor extraction system. The implementation of this technology results in the generation of three waste streams and the use of a significant amount of power, which in itself, generates pollution. The three waste streams are: soil cuttings – approximately 9 cy (Alt. 3B) or 25 cy (Alt. 3A), which would need to be disposed at a RCRA landfill, soil vapor – which would need to be treated by granular activated carbon that ultimately would need to be handled for regeneration or disposal, and steam condensate/groundwater – which would need further treatment in the on-site air stripper or other method. The power usage is estimated to result in the emission of 142 tons (Alt. 3B) or 478 tons (Alt. 3A) of CO_2, 1 ton (Alt. 3B) or 3.5 tons (Alt. 3A) of SO_2, and 0.35 ton (Alt. 3B) or 1.17 tons (Alt. 3A) of NO_x. Even after treatment, some residual VOCs will remain in the soils. Soil confirmation sampling would need to be conducted to determine the levels remaining. These levels may still contribute to the direct contact and migration to groundwater pathways.

It is important to restate that to date, approximately 19,000 lbs of VOCs have been removed from soils at the former WKI facility. A significant portion of the VOCs removed is from the North Area and this system is still in operation. The amount of VOCs remaining in soils in the East and West Areas is estimated to be less than 2 percent of the mass already removed based on existing data. Thus, the performance of any additional corrective measures in these areas should be commensurate with this remaining mass, include consideration of institutional and remedial systems already in place, and be protective of human health and the environment.

After evaluation of each alternative corrective measure with respect to protection of human health and environment, the costs for each have been considered. To date, approximately $1,500,000 has been expended to remove approximately 19,000 lbs of VOCs from the subsurface soils, which is approximately $80/lb VOC removed. For the VOCs remaining in the East and West Areas (less than 2 percent of total mass already removed), costs range from approximately $1,520/lb VOC to $4,650/lb VOC to implement Alternatives 2A, 2B, 3A, and 3B. Alternative 4: Capping/Paving has been estimated at $300/lb VOC. Alternative 2C: Excavation and Disposal – Industrial Soil Standards to 2 Feet bgs is the only other alternative in the same range as Alternative 4 with an approximate cost of $500/lb VOC.

In summary, both the performance of activities under Alternative 4: Capping/Paving and the associated costs are commensurate with the mass of VOCs remaining in the soils while being protective of human health and the environment, and Alternative 4: Capping/Paving has been selected for implementation.

The four RCRA Corrective Action Environmental Indicator Milestones will continue to be met under this scenario. All deed restrictions and restrictions stated in paragraphs 20, 21, 22 of the Consent Order would remain in effect. We would like to implement Alternative 4: Paving/Capping during the summer construction season when it will be most effective to install asphalt. We request your concurrence with this alternative so we will have sufficient lead time to obtain approvals. If you have any questions, please contact me at (610) 701-7360.

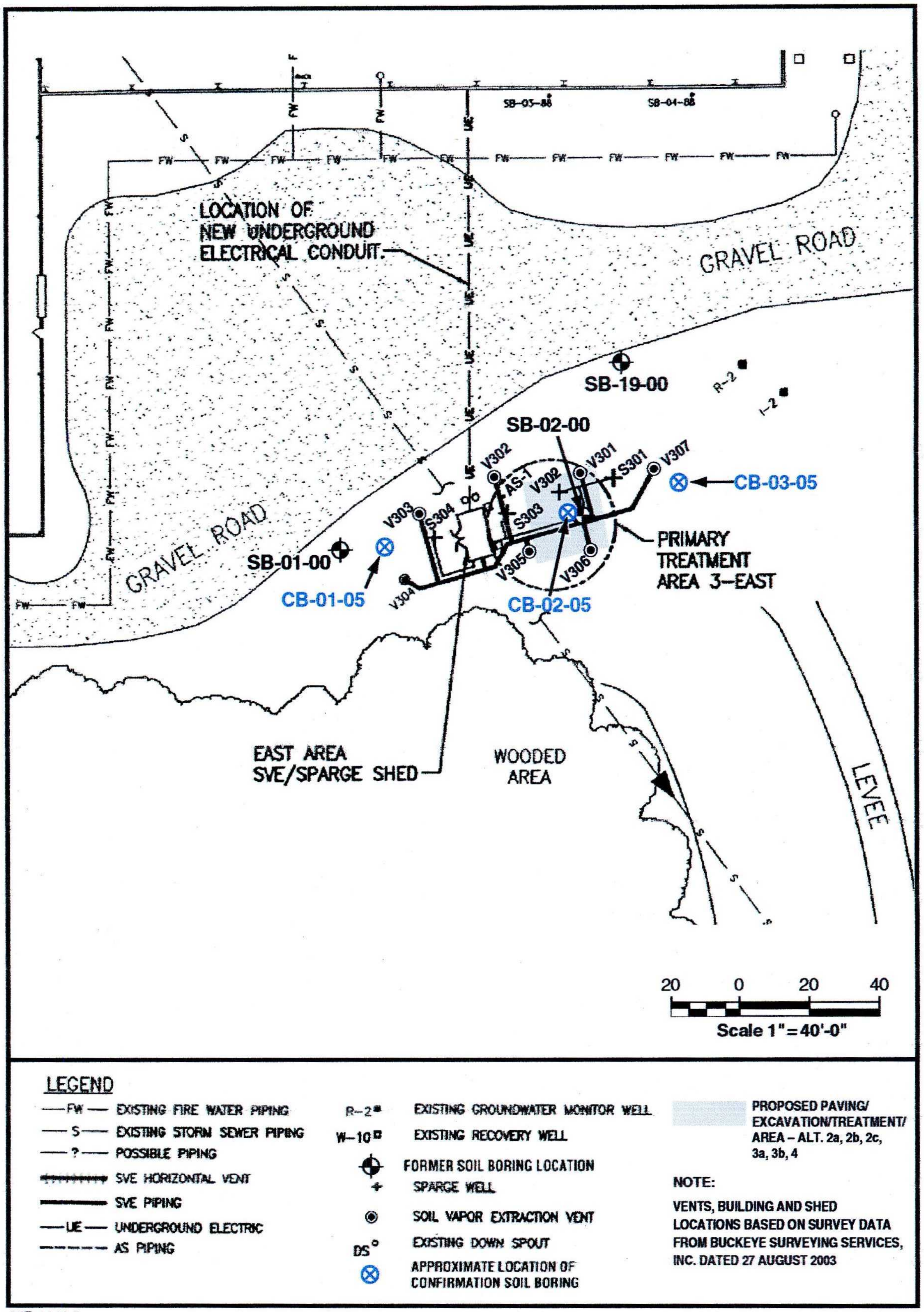
Very truly yours,

WESTON SOLUTIONS, INC.

Thomas Cornuet

Thomas S. Cornuet, P.G.
Project Manager

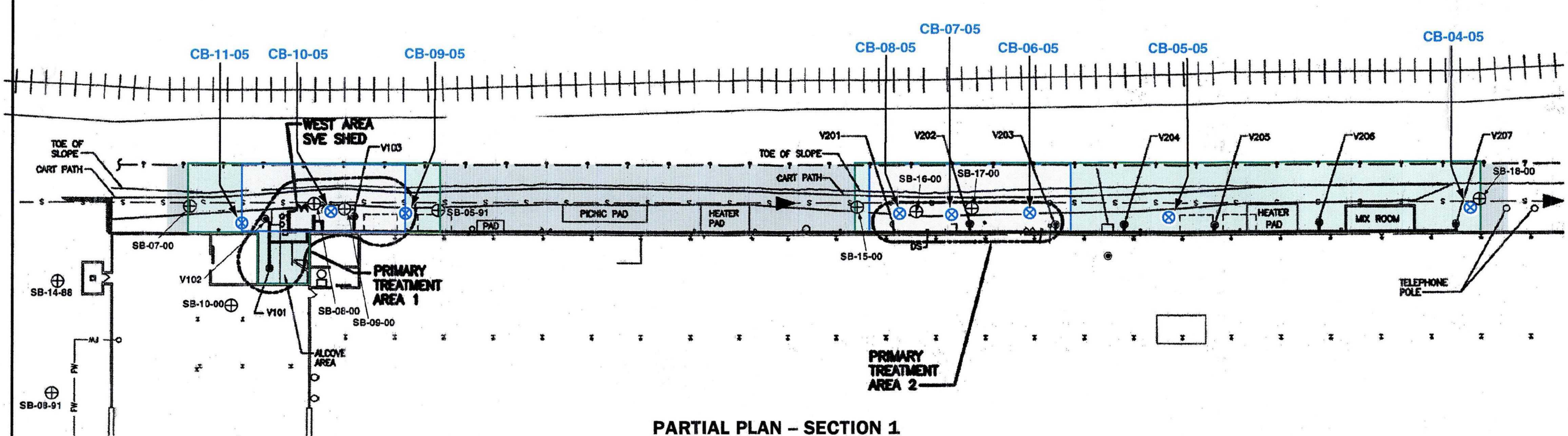
cc: M. Basso, Wyeth
C. Selinsky, American Roll & Hold
J. Rowlett, WKI
J. Savage, Weston
M. Corbin, Weston



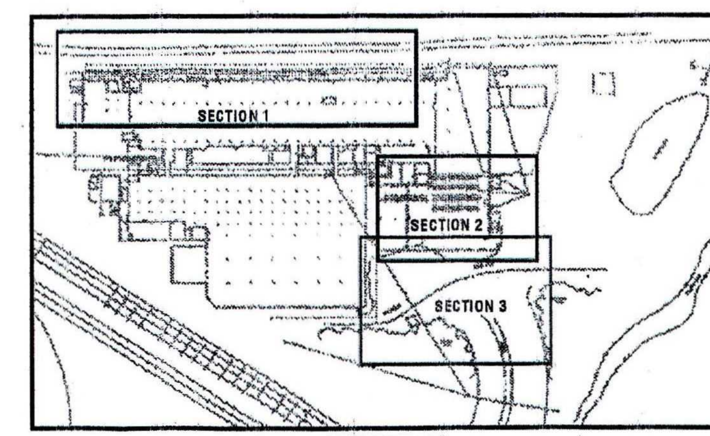
05P-1144-5

FIGURE 1 LOCATION OF EXCAVATION/TREATMENT/CAPPING AREA – EAST AREA

WESTON SOLUTIONS



PARTIAL PLAN – SECTION 1



KEY PLAN
N.T.S.

LEGEND

—FW—	EXISTING FIRE WATER PIPING
++++++++	EXISTING RAIL LINE
—S—	EXISTING STORM SEWER PIPING
—?—	POSSIBLE PIPING
━━	SVE PIPING
DS°	EXISTING DOWN SPOUT
R–2■	EXISTING GROUNDWATER MONITOR WELL
W–10□	EXISTING RECOVERY WELL
⊕	FORMER SOIL BORING LOCATION
●	SOIL VAPOR EXTRACTION VENT
⊗	APPROXIMATE LOCATION OF CONFIRMATION SOIL BORING
	AREA OF CAPPING - ALT. 4
	AREA OF EXCAVATION/TREATMENT - ALT. 2a & 3a
	AREA OF EXCAVATION/TREATMENT - ALT. 2b, 2c, 3b

AS-BUILT DRAWING

20 0 20 40
Scale 1" = 40'-0"

NOTE:
VENTS, BUILDING AND SHED LOCATIONS BASED ON SURVEY DATA FROM BUCKEYE SURVEYING SERVICES, INC. DATED 27, AUGUST 2003

05P-1144-7

FIGURE 2 LOCATION OF EXCAVATION/TREATMENT/ CAPPING AREAS – WEST AREA

Table 1
Summary of Evaluation and Comparison of Supplemental Alternative Corrective Measures
Former WKI Facility, Massillon, Ohio

Evaluation Criteria	Alternative 1: No Further Action	Alternative 2A: Excavation* and Disposal - Soil to Groundwater Standards	Alternative 2B: Excavation* and Disposal - Industrial Soil Standards	Alternative 2C: Excavation* and Disposal - Industrial Soil Standards to 2 Feet bgs	Alternative 3A: Thermal Treatment (Electrical Resistance Heating) - Soil to Groundwater Standards	Alternative 3B: Thermal Treatment (Electrical Resistance Heating) - Industrial Soil Standards	Alternative 4: Capping/Paving
Protection of Human Health and the Environment	Not protective of human health and the environment. Direct contact exposure route is not addressed. Potential impact to groundwater will not be addressed.	Protective of human health and the environment. Direct contact exposure route eliminated. Potential impact to groundwater will be minimized.	Protective of human health and the environment. Direct contact exposure route eliminated. Potential impact to groundwater will be reduced. Groundwater pump and treat system remains in place to address potential impact.	Protective of human health and the environment. Direct contact exposure route eliminated. Potential impact to groundwater will be reduced. Groundwater pump and treat system remains in place to address potential impact. Continuation of the deed restriction will prevent disturbance of subsurface impacted soils deeper than 2 ft bgs.	Protective of human health and the environment. Residual VOCs in soils may provide direct contact route for human exposure. Potential impact to groundwater will be reduced. Groundwater pump and treat system remains in place to address potential impact.	Protective of human health and the environment. Residual VOCs in soils may provide direct contact route for human exposure. Potential impact to groundwater will be reduced. Groundwater pump and treat system remains in place to address potential impact.	Protective of human health and the environment. Direct contact exposure route eliminated. Potential impact to groundwater will be reduced through minimization of infiltration to underlying soils. Groundwater pump and treat system remains in place to address potential impact. Continuation of the deed restriction will prevent disturbance of subsurface impacted soils.
Attainment of Media Cleanup Standards	Does not attain soil performance standards.	Attains soil performance standards for protection of groundwater in soils that are accessible for excavation.	Attains industrial soil performance standards for soils that are accessible for excavation. Does not attain soil performance standards for protection of groundwater as these soils are not targeted for excavation in this alternative and a groundwater pump and treat system remains in place.	Attains industrial soil performance standards for soils to 2 feet bgs and eliminates the direct contact exposure pathway for an outdoor worker. Additionally, there is a deed restriction on the disturbance of subsurface soils (greater than 2 ft bgs) in impacted areas. Does not attain soil performance standards for protection of groundwater as these soils are not targeted for excavation in this alternative and a groundwater pump and treat system remains in place.	Could attain industrial soil performance standards assuming uniform and complete treatment of all impacted soils within the treatment area. May not be able to attain soil performance standards for protection of groundwater, however, a groundwater pump and treat system remains in place.	Could attain industrial soil performance standards assuming uniform and complete treatment of all impacted soils within the treatment area. May not be able to attain soil performance standards for protection of groundwater, however, a groundwater pump and treat system remains in place.	Does not attain industrial soil performance standards, however, the direct contact pathway is eliminated by the cap and there is a deed restriction on the disturbance of soils in impacted areas. Does not attain soil performance standards for protecting groundwater, however, the asphalt cap will minimize infiltration through the impacted soils to the groundwater and pumping system remains in place.
Controls the Source of Releases	Does not control source of release.	Controls the source of releases by removal.	Controls the source of releases by removal. Groundwater pump and treat system remains in place to address the soil to groundwater pathway for residuals.	Controls the source of releases by removal and eliminating the direct contact human exposure pathway. Groundwater pump and treat system remains in place to address the soil to groundwater pathway for residuals.	Controls the source of releases by removal. However, there is some concern regarding translocation of VOCs and residuals.	Controls the source of releases by removal. However, there is some concern regarding translocation of VOCs and residuals.	Controls the source of releases by eliminating the direct contact human exposure pathway and infiltration/migration to groundwater pathways.
Long-Term Effectiveness	Does not provide long-term effectiveness.	Constituents are permanently removed from site.	Constituents are permanently removed from site.	Constituents in the soils to 2 feet bgs are permanently removed from site. Direct contact exposure route is eliminated. Deed restriction will remain in place.	Treatment might be effective, however, many assumptions need to be resolved and some VOCs may remain in soils.	Treatment might be effective, however, many assumptions need to be resolved and some VOCs may remain in soils.	Direct contact human exposure route is eliminated. Potential impact to groundwater will be minimized. Performance of O&M Plan items will ensure integrity and long-term effectiveness of the asphalt cap. Deed restriction will remain in place.
Reduction of Toxicity, Mobility & Volume	No reduction of toxicity, mobility, or volume.	Volume is reduced by excavation and removal of impacted soils.	Volume is reduced by excavation and removal of impacted soils.	Volume is reduced by excavation and removal of impacted soils to 2 feet bgs.	Volume is reduced by in-situ treatment and removal of VOCs.	Volume is reduced by in-situ treatment and removal of VOCs.	Mobility is reduced by the cap; groundwater continues to be protected by pump and treat system.

Table 1
Summary of Evaluation and Comparison of Supplemental Alternative Corrective Measures
Former WKI Facility, Massillon, Ohio

Evaluation Criteria	Alternative 1: No Further Action	Alternative 2A: Excavation* and Disposal - Soil to Groundwater Standards	Alternative 2B: Excavation* and Disposal - Industrial Soil Standards	Alternative 2C: Excavation* and Disposal - Industrial Soil Standards to 2 Feet bgs	Alternative 3A: Thermal Treatment (Electrical Resistance Heating) - Soil to Groundwater Standards	Alternative 3B: Thermal Treatment (Electrical Resistance Heating) - Industrial Soil Standards	Alternative 4: Capping/Paving
Short-Term Effectiveness	Does not produce a waste stream.	Extensive soil disturbance can cause significant volatilization of VOCs and dust hazards to workers and others. Shallow groundwater and stormwater must be pumped out of excavation and treated. Dewatering/drying of wet soils may be needed to meet paint filter test for landfill.	Soil disturbance can cause significant volatilization of VOCs and dust hazards to workers and others. Shallow groundwater and stormwater must be pumped out of excavation and treated. Dewatering/drying of wet soils may be needed to meet paint filter test for landfill.	Soil disturbance can cause some volatilization of VOCs and dust hazards to workers and others. Due to the shallow excavation depth, it is not expected that water will be collected in the excavation. It is not expected that dewatering/drying of soils will be needed since the soils are shallow.	Produces vapor recovery waste condensate stream, which must be treated. An air permit or air permit exemption would be required. There is a potential to emit VOCs if all of the VOCs are not captured by the vapor recovery system. VOCs are located at shallow depths and could be released into the environment. Produces a condensed steam waste stream, which must be treated. Soil waste cuttings are produced through the installation of this technology. It requires approximately 80 borings for installation of electrodes and vapor recovery wells, which results in approximately 25 cy of soil for disposal in a RCRA landfill. Technology requires 783,000 to 849,000 kWhr of power. Using emission factors given by the USEPA to calculate air pollution produced from electricity generating units, WESTON calculated the following mass of air pollutants produced during the treatment process: carbon dioxide (CO_2) - 478 tons, sulfur dioxide (SO_2) - 3.5 tons, and nitrous oxides (NO_x) - 1.17 tons.	Produces vapor recovery waste condensate stream, which must be treated. An air permit or air permit exemption would be required. There is a potential to emit VOCs if all of the VOCs are not captured by the vapor recovery system. VOCs are located at shallow depths and could be released into the environment. Produces a condensed steam waste stream, which must be treated. Soil waste cuttings are produced through the installation of this technology. It requires approximately 35 borings for installation of electrodes and vapor recovery wells, which results in approximately 9 cy of soil for disposal in a RCRA landfill. Technology requires 232,000 to 257,000 kWhr of power. Using emission factors given by the USEPA to calculate air pollution produced from electricity generating units, WESTON calculated the following mass of air pollutants produced during the treatment process: carbon dioxide (CO_2) - 142 tons, sulfur dioxide (SO_2) - 1 ton, and nitrous oxides (NO_x) - 0.35 ton.	Does not produce a significant waste stream other than scraping off surface soil and grass. Can be implemented with minimal disruption of soils and few worker hazards.

Table 1
Summary of Evaluation and Comparison of Supplemental Alternative Corrective Measures
Former WKI Facility, Massillon, Ohio

Evaluation Criteria	Alternative 1: No Further Action	Alternative 2A: Excavation* and Disposal - Soil to Groundwater Standards	Alternative 2B: Excavation* and Disposal - Industrial Soil Standards	Alternative 2C: Excavation* and Disposal - Industrial Soil Standards to 2 Feet bgs	Alternative 3A: Thermal Treatment (Electrical Resistance Heating) - Soil to Groundwater Standards	Alternative 3B: Thermal Treatment (Electrical Resistance Heating) - Industrial Soil Standards	Alternative 4: Capping/Paving
Implementability	Readily implemented.	Difficult to implement. Construction would occur over a period of 1 to 3 months. Excavation is in close proximity to building, utilities, and railroad, and the depth of excavation (to 11 ft bgs) in the West area with very limited space. Due to the age of the facility, there may be unknown structures underground in this area. Extensive shoring is required. Deep excavation requires health and safety measures and shoring to protect workers. Site owner would not have access to the West Area during site activities. Heavy equipment operation in the West Area will be very limited and difficult due to restricted spaces.	Difficult to implement. Construction would occur over a period of 1 to 2 months. Excavation is in close proximity to building, utilities, and railroad, and the depth of excavation (to 8.5 ft bgs) in the West area with very limited space. Due to the age of the facility, there may be unknown structures underground in this area. Extensive shoring is required. Deep excavation requires health and safety measures and shoring to protect workers. Site owner would not have access to the West Area during site activities. Heavy equipment operation in the West Area will be very limited and difficult due to restricted spaces.	Readily implemented. Construction would occur over a period of 2 weeks to 1 month. Since the excavation is shallow, it is not expected to encounter any underground structures and can be performed efficiently. Shoring is not required. Health and safety measures do not need to address shoring or trenches since the excavation is shallow. Site owner would not have access to the West Area during site activities. Since the excavation is shallow, lighter equipment and even hand tools, where necessary, may be used in the West Area. Thus, the space limitations are not as restrictive in this alternative as in Alternatives 2A and 2B.	Moderately difficult to implement. Treatment would occur over 4 to 6 months or more. Numerous soil borings and vents (approximately 75) need to be installed in an area of limited space in the West Area. For reference, the number of SVE vents already in the West Area is ten. Due to the age of the facility, there may be unknown structures underground in this area, which may affect technology implementation. Technology requires work with high voltage and requires appropriate safety measures. Surface cap is required over area to prevent air releases and heat loss from surface. Operation of this technology in winter or wet weather periods may limit effectiveness. Requires soil confirmation sampling, air sampling and treatment, and water (condensate) management and treatment. Site owner would not have access to the West Area during site activities.	Moderately difficult to implement. Treatment would occur over 2 to 3 months or more. Numerous soil borings and vents (approximately 35) need to be installed in an area of limited space in the West Area. For reference, the number of SVE vents already in the West Area is ten. Due to the age of the facility, there may be unknown structures underground in this area, which may affect technology implementation. Technology requires work with high voltage and requires appropriate safety measures. Surface cap is required over area to prevent air releases and heat loss from surface. Operation of this technology in winter or wet weather periods may limit effectiveness. Requires soil confirmation sampling, air sampling and treatment, and water (condensate) management and treatment. Site owner would not have access to the West Area during site activities.	Readily implemented with common construction materials and equipment. Can be implemented over approximately 2-4 weeks. Requires implementation of an O&M Plan for long-term cap integrity. Site owner is amenable to this alternative as it involves minimal disruption to plant operations and allows owner access to the west side of the building. Would not restrict future site use except for excavation.

Table 1
Summary of Evaluation and Comparison of Supplemental Alternative Corrective Measures
Former WKI Facility, Massillon, Ohio

Evaluation Criteria	Alternative 1: No Further Action	Alternative 2A: Excavation* and Disposal - Soil to Groundwater Standards	Alternative 2B: Excavation* and Disposal - Industrial Soil Standards	Alternative 2C: Excavation* and Disposal - Industrial Soil Standards to 2 Feet bgs	Alternative 3A: Thermal Treatment (Electrical Resistance Heating) - Soil to Groundwater Standards	Alternative 3B: Thermal Treatment (Electrical Resistance Heating) - Industrial Soil Standards	Alternative 4: Capping/Paving
Estimated Supplemental Alternative Cost	$0	$1,860,000 (approx. $4,650/lb residual VOC)	$595,000 (approx. $1,980/lb residual VOC)	$155,000 (approx. $500/lb residual VOC)	$750,000 to $870,000 (approx. $1,875 to $2,175/lb residual VOC)	$457,000 to $525,000 (approx. $1,520 to $1,750/lb residual VOC)	$120,000 (approx. $300/lb residual VOC)

Evaluation Criteria	Alternative 1: No Further Action	Alternative 2A: Excavation* and Disposal - Soil to Groundwater Standards	Alternative 2B: Excavation* and Disposal - Industrial Soil Standards	Alternative 2C: Excavation* and Disposal - Industrial Soil Standards to 2 Feet bgs	Alternative 3A: Thermal Treatment (Electrical Resistance Heating) - Soil to Groundwater Standards	Alternative 3B: Thermal Treatment (Electrical Resistance Heating) - Industrial Soil Standards	Alternative 4: Capping/Paving
Estimated Total Cost (including costs to date for existing SVE treatment system)	$1,500,000 (approx. $80/lb VOC removed)	$3,360,000	$2,095,000	$1,655,000	$2,250,000 to $2,370,000	$1,957,000 to $2,025,000	$1,620,000

*Excavation includes treatment, disposal in Subtitle C landfill, and backfilling with clean soil and does not include dewatering.

Former World Kitchen SVE Soil Confirmation Samples

Primary Treatment Area 1 (West)

CB-09-05	TCE @ 22 and 11 ppm	Boring Refusal @ 9'
CB-10-05	TCE @ <0.005 ppm	n/a
CB-11-05	TCE @ 28 and 79 ppm	Boring Refusal @ 8'

Primary Treatment Area 2 (West)

CB-06-05	TCE @ 52 and 200 ppm	Boring Refusal @ 7'
CB-07-05	TCE @ 470 and 40 ppm	Boring Refusal @ 7'
CB-08-05	TCE @ 23 and 130 ppm	Boring Refusal @ 6'

Other (West)

CB-04-05	TCE @ 0.006 and 2.2 ppm	n/a
CB-05-05	TCE @ 1.7 and 0.010 ppm	n/a

1) Five of the eight soil confirmation boring locations showed TCE concentrations greater than the industrial human exposure risk criteria of 6.1 ppm established in the Consent Order.

2) The calculated volume of soil exceeding risk criteria in Primary Treatment Area 1 based on data above and Figure 2 of the May 4, 2006 evaluation is:

20' wide x 60' long x 8.5' (average refusal) = 10,200 cu.ft. = 375 cu. yds

3) The calculated volume of soil exceeding risk criteria in Primary Treatment Area 2 based on data above and Figure 2 of the May 4, 2006 evaluation is:

20' wide x 80' long x 7' (average refusal) = 11,200 cu.ft. = 415 cu. yds

4) Therefore, the total volume of soil to be remediated in the West Area to meet industrial risk exposure criteria is calculated to be:

375 + 415 = 790 cu.yds.

5) Alternative 2 in the May 4, 2006 evaluation identifies the two areas to be remediated as having 978 + 1667 = 2645 cu. yds., over 3x the volume calculated above.

6) Alternative 3 in the May 4, 2006 evaluation (using the same assumptions as Alternative 2) requires 53 electrodes installed to a depth of 11' in a 7400 sq. ft. area. Based on the calculations above, electrodes could only be installed 6' to 9' in depth (because of boring refusal) in a 2800 sq. ft. area. Only 20 electrodes would need to be installed.

7) Based on the calculations above, costs are expected to be substantially different than those calculated in the May 4, 2006 evaluation. For example, ERH technology is typically estimated to cost $90 to $110 per cu. yd. For a soil volume of 790 cu. yds., the estimated cost is $87,000 rather than the $720,000 to $840,000 calculated in the May 4, 2006 evaluation. Likewise, smaller calculated volumes would also substantially reduce costs for excavation and disposal.

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May 4, 2006

Mr. Kenneth Bardo
Project Manager
United States Environmental Protection Agency
Region 5
77 West Jackson Boulevard
Chicago, IL 60604-3590

Re: Evaluation of Supplemental Alternative Corrective Measure Remediation
Former World Kitchen, Inc. Massillon, Ohio Facility
U.S. EPA ID No. OHD 045-205-424

Dear Mr. Bardo:

On behalf of Wyeth and World Kitchen, Inc. (WKI), Weston Solutions, Inc. (WESTON®) is providing to the United States Environmental Protection Agency (U.S. EPA) an evaluation of four supplemental alternative corrective measures for the "West" (i.e., Area 1-West and Area 2-West) and "East" (i.e., Area 3–East) Areas of the former World Kitchen, Inc. Massillon, Ohio facility. This evaluation has been performed in accordance with the requirements of the Administrative Order on Consent (Consent Order) between U.S. EPA, WKI, and Wyeth set forth in Attachment 2, Section 4.1b, which allows Wyeth to submit an evaluation of engineering controls as an alternative corrective measure to supplement the original site corrective measure.

As previously discussed in detail in the January 30, 2006 Letter Report to you, the soil vapor extraction (SVE) and air sparging systems at the former WKI facility have been in operation for approximately 2½ years and have removed more than 19,293 pounds of volatile organic compounds (VOC). Additionally, the WKI facility has met four of the five RCRA Corrective Action - Environmental Indicator (EI) Milestones that are listed below:

	Environmental Indicator	**Date Completed**
CA400	Remedy Selection Completed	8/6/02
CA550	Certification of Remedy Completion	9/12/03
CA725	Current Human Exposures Under Control	10/10/01
CA750	Migration of Contaminated Groundwater Under Control	12/19/00
CA999	Corrective Action Completed	----

As noted in the recent Quarterly Progress Report dated February 15, 2006, the VOC concentrations in the extracted air from all of the treatment areas: North, East, and West, have diminished significantly from initial startup concentrations and are now at asymptotic levels, meaning that equilibrium has been reached and only significantly low to non-detectable concentrations of site-specific target compounds remain in the extracted soil vapor. Continued operation of the East and West systems is providing little to no benefit and does not result in measurable mass removal. Based on this information, Wyeth requested in the January 30, 2006 Letter Report that the East and West SVE systems be closed down and that engineering controls be put in place to supplement the original site corrective measure. Wyeth proposed that the East and West SVE areas be paved to prevent direct contact and minimize infiltration of precipitation. During a conference call with you on February 14, 2006, U.S. EPA requested that additional alternative corrective measures be evaluated for the East and West Areas and provided two examples: excavation of impacted soils and electrical resistance heating (ERH). The following is a description of the alternative corrective measures followed by an evaluation and comparison of the alternatives presented in tabular format and selection for implementation based on this evaluation. The No Further Action alternative (Alternative 1) is provided for baseline comparison.

Under all scenarios, the groundwater pump and treat system will continue to operate and migration of contaminated groundwater (CA750) will remain under control.

<u>Description of Alternative 1: No Further Action</u>

In this alternative, no further corrective action would be conducted at the East and West Areas in addition to the SVE corrective measure completed in those areas. The East and West Area SVE and sparge systems would be decommissioned. Specifically, the ten SVE vents in the West Area and seven SVE vents and four air sparging wells in the East Area would be removed.

<u>Description of Alternative 2: Excavation and Disposal</u>

In this alternative, soils with concentrations greater than the industrial soil performance standards presented in Attachment 1 of the Consent Order, would be excavated and transported off-site for disposal in a Resource Conservation and Recovery Act (RCRA)-permitted hazardous waste landfill (Subtitle C landfill). Excavated areas would be backfilled with clean fill.

In the East Area, an area approximately 20 feet long by 20 feet wide by 6 feet deep would be excavated (90 cy) (See Figure 1). In the West Area, two separate areas would be excavated (See Figure 2). The dimensions of the areas are the following: Area 1-West, approximately 120 feet long x 20 feet wide x 11 feet deep (978 cy) (extending from approximately SB-07-00 to SB-05-91) and Area 2-West, approximately 250 feet long x 20 feet wide x 9 feet deep (1667 cy) (extending from approximately SB-15-00 to SB-18-00). The excavation would abut the west side of the building and the railroad embankment. Due to the depth of the excavation, shoring would be required to prevent soil sloughing, building damage, and undermining the railroad bed. There is an underground sewer pipe that runs parallel to the building along the length of the area. The excavation and shoring would be required to avoid damaging this sewer pipeline. Due to the age of the facility and the dated utility drawing, it is uncertain if there are any other obstructions in the subsurface in this area. As part of the excavation effort, all ten SVE vents in the West Area and seven SVE vents and four air sparging wells in the East Area would have to be removed. Additionally, water from storm events and perched water from surrounding areas would infiltrate or flow into the open excavation. It would be necessary to install a pump into the excavation to remove this water and keep the excavation dry until it is backfilled. The water would have to be sent through the existing on-site air stripper for treatment before discharge or transported off-site for treatment and disposal. The excavated area would be backfilled with clean fill.

The following assumptions were used to evaluate this alternative:

- The subject areas would be excavated and the soils transported off-site for treatment and disposal in a Subtitle C landfill. Some soils in the West Area contain trichloroethylene (TCE) concentrations greater than 10 times its Universal Treatment Standard (UTS) of 6 mg/kg. These soils would require additional treatment before placement in the RCRA landfill.

- No additional drying or dewatering would be required for soils to meet the paint filter test for land disposal.

- Extensive shoring would be required particularly in the West Area to keep the excavation open and prevent structural damage to the building and railroad bed. The East Area excavation could include shoring to limit the overexcavation which would occur from cutting back the sideslopes of the excavation to reach the required six foot depth.

- Water from the excavation would be treated in the on-site air stripper.

- The railroad would approve this activity in the West Area which extends into its right-of-way.

- Excavation in these areas would not affect plant vehicular traffic.

- The area would be backfilled with clean fill and surfaced to accommodate vehicular traffic.

Description of Alternative 3: Thermal Treatment – Electrical Resistance Heating (ERH)

Electrical Resistance Heating (ERH) is an in situ thermal technology that uses resistance heating and steam stripping to remove volatile and semivolatile organic compounds from the subsurface. The technology applies electricity into the ground through electrodes. The soil temperature is raised to the boiling point of water and the volatile compounds transition to the vapor phase and are captured by a vapor recovery system.

Approximately 53 electrodes would be installed into the subsurface and would extend from 1 to 11 feet below ground surface (bgs). The electrodes would be located approximately 13 feet apart. Although 53 vapor recovery wells would be co-located in the same borehole with the electrodes, an additional 25 wells would be installed for vapor recovery. Five temperature monitoring points, each with four sensors also would be installed to monitor the subsurface heating. An insulating surface cap would need to be installed to prevent vapors from being released to the ambient air. It is estimated that the treatment system would operate for approximately 98-147 days and would require 783,000 to 849,000 kW-hr of power.

At the end of the treatment session, confirmatory soil sampling would be required to determine effectiveness. If the treatment goals are not achieved, the system would be operated for an additional length of time. Upon final treatment, all vents and wells would be abandoned in place.

A vapor recovery and treatment system (i.e., activated carbon) would be required. Approximately 1 gallon per minute (gpm) of condensate would be produced and require collection for treatment/disposal. It is also likely that shallow groundwater would be pulled by vacuum into the 78 vapor recovery wells. This was a major operational limitation with the SVE system.

The following assumptions were used to evaluate this alternative:

- The drill cuttings from the soil borings (approximately 25 cy) would be transported off-site for treatment and disposal in a Subtitle C landfill. Some soils in the West Area contain TCE concentrations greater than 10 times its UTS of 6 mg/kg. These soils would require additional treatment before placement in the RCRA landfill.

- Treatment and heating would not translocate the VOCs out of the treatment area or deeper in groundwater.

- High voltage power would be available on-site.

- Sufficient air flow would be attained to collect vapors in the tight, wet soils. The existing SVE system did not achieve extensive air flow and the 13-foot spacing may not be enough.

- Significant short-circuiting of the resistance heating in the soils or heat loss at the soil surface would not occur.

- Surface coverage and restricted access in these areas would not affect plant vehicle access.

- Unknown underground obstructions which may exist in the areas would not negatively impact installation of the treatment system or soil treatment.

- The railroad would permit this activity for the West Area which extends into its right-of-way.

Description of Alternative 4: Paving/Capping

This alternative consists of paving/capping both the East and West areas with asphalt. It would be designed to prevent direct contact with underlying soils and to minimize infiltration to these soils. Specifically, soils containing concentrations exceeding the soil performance standards for protection of groundwater (approximately 9,000 sq ft of area) would be paved. A compacted gravel and stone base would be placed first as the sub-base followed by an asphalt paving layer. All SVE vents and air sparging wells in both the East and West Areas would be closed in place. In the West Area, the pavement would be sloped to drain away from the building and toward the existing storm drain inlets to the extent possible. An Operation and Maintenance (O&M) Plan would be prepared to include inspections and maintenance to assure integrity of the asphalt cap. Additionally, the deed restriction preventing excavation and disturbance of impacted subsurface soils in the East and West Areas would be retained.

The following assumptions were used to evaluate this alternative:

- The top 3 inches of soil and grass would be removed before placement of the stone sub-base and paving. The excavated topsoil would be sampled to determine the appropriate soil profiling for disposal.

- Additional storm water drainage piping and inlets would not be required.

- Railroad permission would not be needed for this activity in the West Area.

Table 1 provides a summary and comparison evaluation of these four alternative corrective measures for supplementing the SVE corrective measure completed in the East and West Areas at the former WKI facility.

Selected Supplemental Alternative Corrective Measure

Based on the evaluation and comparison of the four alternative corrective measures presented in Table 1, WESTON selects implementation of Alternative 4: Capping/Paving. When compared to Alternative 1: No Further Action, Alternative 4: Capping/Paving includes additional measures to provide appropriate protection of human health and the environment. It provides the same level of environmental protection as Alternatives 2 and 3 with less short-term impacts and implementation uncertainties. Alternative 4: Capping/Paving uses a physical barrier to be protective of human health and the environment. It prevents direct contact exposure with underlying soils and minimizes infiltration to the groundwater. A deed restriction notice and its associated O&M activities and schedule will be put in place to maintain the long-term integrity of the cap and prevent subsurface infiltration. This alternative, combined with continued operation of the groundwater remediation system and deed restriction measures/O&M activities, will ensure protection of human health and the environment. It will be readily implemented with little disruption to site activities and negligible generation of waste.

While Alternative 2: Excavation and Alternative 3: Thermal Treatment (Electrical Resistance Heating) may also be protective of human health and the environment, there were a number of factors that precluded these alternatives from being selected for implementation. With respect to Alternative 2: Excavation, the extensive soil disturbance (to a depth of 11 feet bgs) in an area of restricted space with underground piping (possibly some unknown structures), there are numerous concerns for the West Area with compromising the building structure and the nearby railroad bed. Extensive shoring would be necessary to prevent damage to adjacent structures and minimize overexcavation. Permission for excavation activities would be required from the railroad as its right-of-way would be impacted. It is uncertain whether this permission would be granted. The short-term impact from the earthmoving activities would result in significant volatilization of VOCs and generation of dust, which would require control.

With respect to Alternative 3: Thermal Treatment (Electrical Resistance Heating), extensive activities would be conducted to address this remaining residual VOC mass, which could be addressed by less invasive means and result in fewer short-term impacts. For example, to implement this technology, approximately 80 borings would need to be drilled to install not only the electrodes (approximately 53) for electrical resistance heating, but an additional 25 vents for soil vapor recovery. Since the residual VOCs are located in shallow soils, extra caution would need to be taken to prevent air releases from the surface and a cap would need to be placed over the area to be treated. Even so, there is some concern that some of the vapors could translocate out of the treatment area and not be entirely retrieved by the vapor extraction system. The implementation of this technology results in the generation of three waste streams and the use of a significant amount of power, which in itself, generates pollution. The three waste streams are: soil cuttings – approximately 25 cy, which would need to be disposed at a RCRA landfill, soil vapor – which would need to be treated by granular activated carbon that ultimately would need to be handled for regeneration or disposal, and steam condensate/groundwater – which would need further treatment in the on-site air stripper or other method. The power usage is estimated to result in the emission of 478 tons of CO_2, 33.5 tons of SO_2, and 1.17 tons of NO_x. Even after treatment, some residual VOCs will remain in the soils. Soil confirmation sampling would need to be conducted to determine the levels remaining. These levels may still contribute to the direct contact and migration to groundwater pathways. As with the excavation alternative corrective measure, permission to conduct the electrical resistance heating within the railroad right-of-way would be required. It is uncertain whether this could be obtained.

It is important to restate that to date, approximately 19,000 lbs of VOCs have been removed from soils at the former WKI facility. A significant portion of the VOCs removed is from the North Area and this system is still in operation. The amount of VOCs remaining in soils in the East and West Areas is estimated to be less than 2 percent of the mass already removed based on existing data. Thus, the performance of any additional corrective measures in these areas should be commensurate with this remaining mass, include consideration of institutional and remedial systems already in place, and be protective of human health and the environment.

After evaluation of each alternative corrective measure with respect to protection of human health and environment, the costs for each have been considered. To date, approximately $1,500,000 has been expended to remove approximately 19,000 lbs of VOCs from the subsurface soils, which is approximately $80/lb VOC removed. For the VOCs remaining in the East and West Areas (less than 2 percent of total mass already removed), it would cost approximately $6,230/lb VOC to implement Alternative 2: Excavation, and $2,800/lb VOC to implement Alternative 3: Thermal Treatment (Electrical Resistance Heating). Alternative 4: Capping/Paving has been estimated at $400/lb VOC.

In summary, both the performance of activities under Alternative 4: Capping/Paving and the associated costs are commensurate with the mass of VOCs remaining in the soils while being protective of human health and the environment, and Alternative 4: Capping/Paving has been selected for implementation.

The four RCRA Corrective Action Environmental Indicator Milestones will continue to be met under this scenario. All deed restrictions and restrictions stated in paragraphs 20, 21, 22 of the Consent Order would remain in effect. We would like to implement Alternative 4: Paving/Capping during the summer construction season when it will be most effective to install asphalt. We request your concurrence with this alternative so we will have sufficient lead time to obtain approvals.

If you have any questions, please contact me at (610) 701-7360.

Very truly yours,

WESTON SOLUTIONS, INC.

Thomas Cornuet

Thomas S. Cornuet, P.G.
Project Manager

cc: M. Basso, Wyeth
C. Selinsky, American Roll & Hold
J. Rowlett, WKI
J. Savage, Weston
M. Corbin, Weston

Table 1
Summary of Evaluation and Comparison of Supplemental Alternative Corrective Measures
Former WKI Facility, Massillon, Ohio

Evaluation Criteria	Alternative 1: No Further Action	Alternative 2: Excavation*	Alternative 3: Thermal Treatment (Electrical Resistance Heating)	Alternative 4: Capping/Paving
Protection of Human Health and the Environment	Not protective of human health and the environment. Direct contact exposure route is not addressed for subsurface excavation/utility worker. Potential impact to groundwater will not be addressed.	Protective of human health and the environment. Direct contact exposure route eliminated. Potential impact to groundwater will be minimized.	Protective of human health and the environment. Residual VOCs in soils may provide direct contact route for human exposure. Potential impact to groundwater will be reduced.	Protective of human health and the environment. Direct contact exposure route eliminated. Potential impact to groundwater will be reduced. Continuation of the deed restriction will prevent disturbance of subsurface impacted soils.
Attainment of Media Cleanup Standards	Does not attain soil performance standards.	Attains industrial soil performance standards for soils that are accessible for excavation. Does not attain soil performance standards for protecting groundwater as these soils are not targeted for excavation in this alternative.	Could attain industrial soil performance standards assuming uniform and complete treatment of all impacted soils within the treatment area. May not be able to attain soil performance standards for protecting groundwater.	Does not attain industrial soil performance standards, however, the direct contact pathway is eliminated by the cap and there is a deed restriction on the disturbance of soils in impacted areas. Does not attain soil performance standards for protecting groundwater, however, the asphalt cap will minimize infiltration through the impacted soils to the groundwater and pumping system remains in place.
Controls the Source of Releases	Does not control source of release.	Controls the source of releases by removal.	Does not control completely the source of releases, as some VOCs will remain in the soils after treatment or be translocated.	Controls the source of releases by eliminating the direct contact and infiltration/migration to groundwater pathways.
Long-Term Effectiveness	Does not provide long-term effectiveness.	Constituents are permanently removed from site.	Treatment might be effective, however, many assumptions need to be resolved and some VOCs may remain in soils.	Direct contact exposure route is eliminated. Potential impact to groundwater will be minimized. Performance of O&M Plan items will ensure integrity and long-term effectiveness of the asphalt cap. Deed restriction will remain in place.
Reduction of Toxicity, Mobility & Volume	No reduction of toxicty, mobility, or volume.	Volume is reduced by excavation and removal of impacted soils.	Volume is reduced by in-situ treatment and removal of VOCs.	Mobility is reduced by the cap; groundwater continues to be protected by pump and treat system.

Table 1
Summary of Evaluation and Comparison of Supplemental Alternative Corrective Measures
Former WKI Facility, Massillon, Ohio

Evaluation Criteria	Alternative 1: No Further Action	Alternative 2: Excavation*	Alternative 3: Thermal Treatment (Electrical Resistance Heating)	Alternative 4: Capping/Paving
Short-Term Effectiveness	Does not produce a waste stream.	Extensive soil disturbance can cause significant volatilization of VOCs and dust hazards to workers and others. Shallow groundwater and stormwater must be pumped out of excavation and treated. Dewatering/drying of wet soils may be needed to meet paint filter test for landfill.	Produces vapor recovery waste condensate stream, which must be treated. An air permit or air permit exemption would be required. There is a potential to emit VOCs if all of the VOCs are not captured by the vapor recovery system. VOCs are located at shallow depths and could be released into the environment. Produces a condensed steam waste stream, which must be treated. Soil waste cuttings are produced through the installation of this technology. It requires approximately 80 borings for installation of electrodes and vapor recovery wells, which results in approximately 25 cy of soil for disposal in a RCRA landfill. Technology requires 783,000 to 849,000 kWhr of power. Using emission factors given by the USEPA to calculate air pollution produced from electricity generating units, WESTON calculated the following mass of air pollutants produced during the treatment process: carbon dioxide (CO_2) - 478 tons, sulfur dioxide (SO_2) - 33.5 tons, and nitrous oxides (NO_x) - 1.17 tons.	Does not produce a significant waste stream other than scraping off surface soil and grass. Can be implemented with minimal disruption of soils and few worker hazards.

Table 1
Summary of Evaluation and Comparison of Supplemental Alternative Corrective Measures
Former WKI Facility, Massillon, Ohio

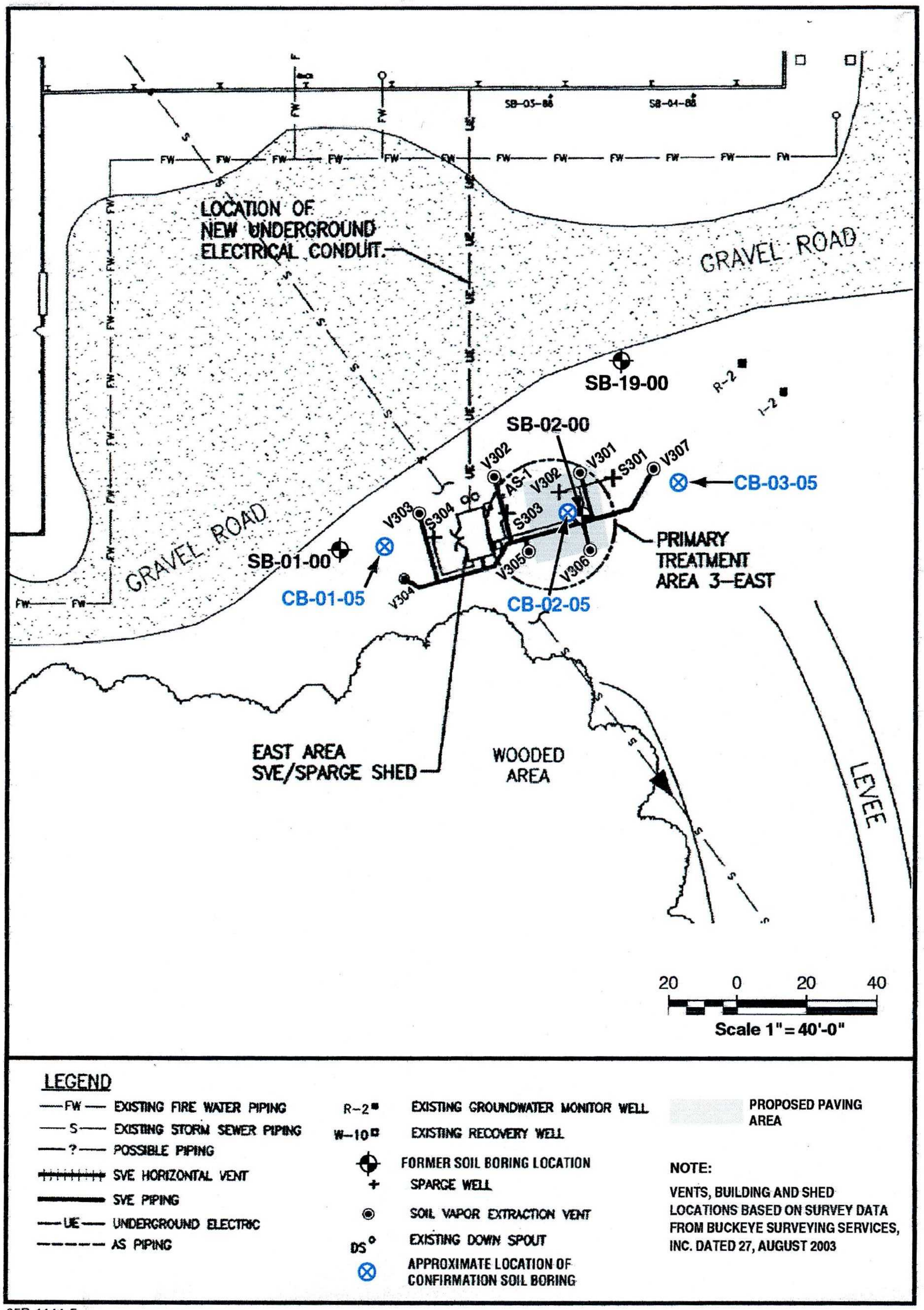
Evaluation Criteria	Alternative 1: No Further Action	Alternative 2: Excavation*	Alternative 3: Thermal Treatment (Electrical Resistance Heating)	Alternative 4: Capping/Paving
Implementability	Readily implemented.	Difficult to implement. Construction would occur over a period of 1 to 3 months. Excavation is in close proximity to building, utilities, and railroad, and the depth of excavation (to 11 ft bgs) in the West area with very limited space. Due to the age of the facility, there may be unknown structures underground in this area. Extensive shoring is required. Deep excavation requires health and safety measures and shoring to protect workers. Railroad permission would be required as the excavation would extend into its right-of-way. Uncertain if permission would be granted. Site owner would not have access to the West Area during site activities. Heavy equipment operation in the West Area will be very limited and difficult due to restricted spaces.	Moderately difficult to implement. Treatment would occur over 4 to 6 months or more. Numerous soil borings and vents (approximately 75) need to be installed in an area of limited space in the West Area. For reference, the number of SVE vents already in the West Area is ten. Due to the age of the facility, there may be unknown structures underground in this area, which may affect technology implementation. Technology requires work with high voltage and requires appropriate safety measures. Surface cap is required over area to prevent air releases and heat loss from surface. Operation of this technology in winter or wet weather periods may limit effectiveness. Requires soil confirmation sampling, air sampling and treatment, and water (condensate) management and treatment. Railroad permission would be required as the treatment area would extend into its right-of-way. Uncertain if permission would be granted. Site owner would not have access to the West Area during site activities.	Readily implemented with common construction materials and equipment. Can be implemented over approximately 2-4 weeks. Requires implementation of an O&M Plan for long-term cap integrity. Railroad permission would likely be granted for this activity, which is not intrusive, but would extend into its right-of-way. Site owner is amenable to this alternative as it involves minimal disruption to plant operations and allows owner access to the west side of the building. Would not restrict future site use except for excavation.

Table 1
Summary of Evaluation and Comparison of Supplemental Alternative Corrective Measures
Former WKI Facility, Massillon, Ohio

Evaluation Criteria	Alternative 1: No Further Action	Alternative 2: Excavation*	Alternative 3: Thermal Treatment (Electrical Resistance Heating)	Alternative 4: Capping/Paving
Estimated Supplemental Alternative Cost	$0	$1,870,000 (approx. $6,230/lb residual VOC)	$720,000 to $840,000 (approx. $2,400 to $2,800/lb residual VOC)	$120,000 (approx. $400/lb residual VOC)

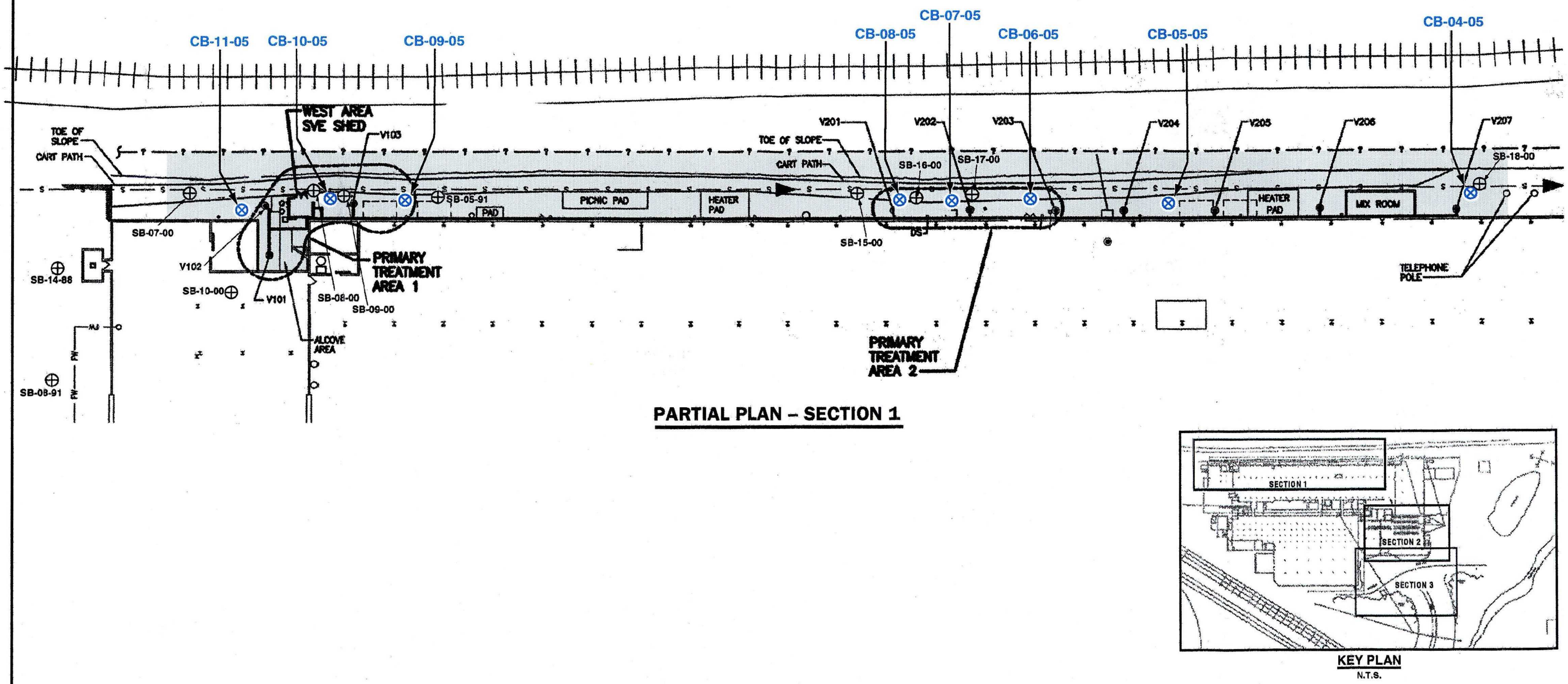
Evaluation Criteria	No Further Action	Alternative 2: Excavation*	Thermal Treatment (Electrical Resistance	Alternative 4: Capping/Paving
Estimated Total Cost (including costs to date for existing SVE treatment system)	$1,500,000 (approx. $80/lb VOC removed)	$3,200,000	$2,100,000 to $2,200,000	$1,620,000

*Excavation includes treatment, disposal in Subtitle C landfill, and backfilling with clean soil and does not include dewatering.



05P-1144-5

FIGURE 1 LOCATION OF EXCAVATION/TREATMENT/CAPPING AREA – EAST AREA



LEGEND

—FW— EXISTING FIRE WATER PIPING	R–2 EXISTING GROUNDWATER MONITOR WELL
EXISTING RAIL LINE	W–10 EXISTING RECOVERY WELL
—S— EXISTING STORM SEWER PIPING	FORMER SOIL BORING LOCATION
—?— POSSIBLE PIPING	SOIL VAPOR EXTRACTION VENT
SVE PIPING	APPROXIMATE LOCATION OF CONFIRMATION SOIL BORING
DS° EXISTING DOWN SPOUT	PROPOSED PAVING AREA

AS–BUILT DRAWING

20 0 20 40
Scale 1" = 40'-0"

NOTE:
VENTS, BUILDING AND SHED LOCATIONS BASED ON SURVEY DATA FROM BUCKEYE SURVEYING SERVICES, INC. DATED 27, AUGUST 2003

05P-1144-6

FIGURE 2 LOCATION OF EXCAVATION/TREATMENT/ CAPPING AREA – WEST AREA

SECOND ADDENDUM TO THE CORRECTIVE MEASURES STUDY (November 1993)

EKCO HOUSEWARES, INC. MASSILLON, OHIO

U.S. EPA ID No. OHD 045-205-4261

May 2001

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1. DESCRIPTION OF CURRENT SITUATION

1.1 PROJECT OVERVIEW

This second addendum contains the results of a re-evaluation of the findings and recommendations of the Corrective Measures Study (CMS) for the EKCO Housewares, Inc. (EKCO) facility in Massillon, Ohio. The CMS findings and recommendations were revised as a result of the new soil cleanup goals requested by the U.S. Environmental Protection Agency (EPA) in August 2000 and a soil investigation conducted at the EKCO facility in September 2000.

Roy F. Weston, Inc. (WESTON®) was contracted in 1991 to conduct a Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) for the EKCO facility CMS. A summary of the site history and environmental activities is presented in Table 1-1. The RFI/CMS work is being performed in accordance with an Administrative Order on Consent (Consent Order), signed between EKCO and the EPA in March/April 1989.

The Draft RFI Report was submitted to the EPA in August 1992. EPA comments were subsequently received in April 1993. A Final RFI Report and written responses to EPA comments were submitted in May 1993. Additional EPA comments were received in July 1993. Revised pages of the Final RFI Report, as well as responses to these comments, were submitted to EPA in August 1993. A letter dated 3 November 1993 was received from EPA, indicating agency approval of the RFI with modifications (attached to the letter).

The Draft CMS Report was initiated shortly after the revisions to the Final RFI Report and submitted to EPA in September 1993. EPA comments on the Draft CMS Report, dated 21 October 1993, were received. The Final CMS Report was submitted to EPA in November 1993. A letter dated 8 February 1994 was received from EPA indicating agency approval of the CMS.

The primary component of the groundwater remedial alternatives presented in the CMS is a groundwater pump-and-treat program utilizing on-site production wells W-1 and W-10. EKCO has been operating a pump and treat system with these wells since an air stripper was installed in

Table 1-1

Summary of Site History and Environmental Activities

Date	EKCO Site Activity
Circa 1929-32	First recorded activities at facility. Property is owned by Standard Oil Company.
Circa 1929-42	Fort Pitt/Massillon Bridge Works – Manufacture of iron and steel bridges and structural iron.
1945	Manufacturing aluminum and stainless steel cookware. (Well W-10 installed in 1943.)
1951	With the U.S. involvement in the Korean Conflict, the plant began manufacturing 90-mm and 105-mm shell casings for the military. This increase in production necessitates the drilling of two additional production wells (W-1 and W-2). Well W-1 has been used continuously since then, and well W-2 was used until it was taken out of service in the late 1970s.
1953	A surface impoundment was constructed along the northern property boundary adjacent to Newman Creek. Sludge frame waste treatment was discharged to it. Began copper-plating cookware; used primarily TCE or 1,1,1-TCA to clean cookware.
1964	Stopped using TCE, 1,1,1-TCA was used in its place.
1965	AHPC acquired EKCO Housewares.
1967	Installation of porcelain and Teflon coating units.
1969	Surface impoundment meets newly formed NPDES regulations and permits.
July 1974	NPDES Permit No. C-3094BD was issued to EKCO.
1977	EKCO discontinued the manufacturing of aluminum and porcelain cookware and the use of the lagoon ceased.
1978	All copper plating operations ended; the principal manufactured products were pressed and coated nonstick bakeware.
1979-1980	The only major documented solvent spill to date at the facility was recorded; neither the exact location nor the extent of the spill was documented.
1980	The surface impoundments were reactivated under the existing NPDES permit and received alkaline degreaser filter water.
March 1984	In applying for a renewal of their NPDES permit, the plant was required to analyze on-site well water for VOCs; this analysis indicated the presence of 1,1,1-TCA and TCE.
June 1984	All discharges to lagoon ceased.
1984	AHPC sold EKCO Housewares to the EKCO Group.
Fall 1984	Seven soil borings were drilled; four in the overburden and three in the bedrock. Two of the overburden holes were completed as 1¼-inch (I.D.)

Table 1-1 (Continued)

Summary of Site History and Environmental Activities

Date	EKCO Site Activity
	piezometers and the three bedrock holes were completed as 6-inch (I.D. casing) bedrock wells (R-1 through R-3).
July 1985	An additional bedrock well (R-4) was installed along the eastern boundary. No VOCs were found.
February 1986	An air stripper was installed on-site and put into service. The discharge of the stripper was directed to Newman Creek.
June 1986	Floyd Brown Associates (FBA) developed a preliminary closure plan for the lagoon. Phase I of the plan called for 12 soil borings. No VOCs were detected in any of the borings.
January/February 1987	A more intensive soil boring program (Phase II) was conducted by FBA. The program consisted of 25 soil borings. Four of the borings were completed as 1 ½ -inch (I.D.) PVC wells to monitor the lagoon.
July 1987	WESTON was contracted to develop a final closure program for the lagoon and to develop a groundwater quality assessment program.
September 1987	WESTON conducted a baseline assessment of the EKCO facility which included sampling of all on-site wells, including Ohio Water Service (OWS) well #4, collecting OVA readings, well construction information and water level measurements, surveying on-site wells, groundwater utilization survey and a review of plant records.
February 1988	WESTON began monthly sampling of OWS wells #1, 2, 3, and 5. These wells were sampled until March 1990.
June/July 1988	Installation of 13 monitor wells, eight of which were installed to characterize the stratigraphy of water-bearing zones, to determine the depth of bedrock and to assess the hydraulic interconnection between the unconsolidated sand, gravel and clay aquifer and the Pottsville sandstone. The other five wells were installed in accordance with RCRA Part 265, Subpart F, for surface impoundment closure.
December 1988	WESTON performed a soil gas survey to identify potentially contaminated areas. Soil borings identified by the soil gas survey were advanced to determine the vertical extent of any contamination. WESTON also sampled all on-site wells, including the on-site production wells.
May 1989	WESTON began the quarterly sampling of the five lagoon wells (L-1 through L-5).
April 1991	WESTON conducted packer tests to evaluate the extent of interconnection between overburden and bedrock wells.
June/August 1991	WESTON installed 13 monitor wells to evaluate off-site groundwater conditions.

Table 1-1 (Continued)

Summary of Site History and Environmental Activities

Date	EKCO Site Activity
September 1991	WESTON sampled all monitor wells and production wells.
March 1992	WESTON sampled all monitor wells and production wells.
May 1992	EKCO reported a 330-gallon 1,1,1-TCA spill northwest of the plant building and removed 50 tons of soil from the spill area.
May 1993	WESTON submitted the Final RFI Report to the USEPA.
August 1993	WESTON initiated lagoon closure activities at the site.
September 1993	WESTON submitted the CMS Report to the USEPA.
November 1993	USEPA approved the Final RFI Report.
November 1993	USEPA approved the CMS Report with changes.
April/May 1994	WESTON conducted Interim Remedial Measures which included the rehabilitation of observation wells R-1, R-2, and R-3 and production wells W-1, W-2, and W-10, and abandoned well D-4-30.
June 1994	WESTON submitted a notice to OEPA announcing that the lagoon closure activities were completed.
November 1994	WESTON submitted a Baseline Health Risk Assessment Report to the USEPA.
January 1995	OEPA determined that the lagoon had been closed in accordance with the approved Closure Plan and Rules 3745-66-12 through 3745-66-15 of the Ohio Administrative Code.
May 1995	WESTON and AHP received direction from OEPA and USEPA that the quarterly groundwater sampling that had been conducted since 1989 was no longer required due to the official closure of the lagoon. A modified groundwater sampling program was implemented.
April 1996	USEPA issued the Draft Statement of Basis which explained the proposed remedy for cleaning up the site.
August/September 1996	USEPA accepted comments from the public on the Draft Statement of Basis for the site.
September 1996	USEPA held a public meeting to present the Draft Statement of Basis for the site.
September 1996	AHP and WESTON submitted comments on the Draft Statement of Basis for the site to the USEPA.
August 2000	USEPA requested that new soil cleanup goals be calculated using the EPA Soil Screening Guidance.
September 2000	AHP and WESTON calculated new soil cleanup goals and collected 54 soil samples from 19 soil borings to evaluate current soil contaminant concentrations at the site.

Table 1-1 (Continued)

Summary of Site History and Environmental Activities

Date	EKCO Site Activity
November 2000	AHP and WESTON submitted a Draft Soil Investigation Report to the USEPA, presenting the results of the September 2000 soil sampling.
December 2000	USEPA provided comments on the Draft Soil Investigation Report.
February 2001	AHP and WESTON completed the Final Soil Investigation Report.
Present	EKCO continues to manufacture pressed and coated nonstick bakeware. Contaminated groundwater is extracted using wells W-1 and W-10 and treated with the on-site air stripper system.

1986. An examination of groundwater elevation data collected from site monitor and pumping wells shows that the capture zone for the two production wells, W-1 and W-10, extends well beyond the EKCO property. Figures 1, 2, and 3 in Appendix 1 of the *February 2001 Soil Investigation Report* (provided in Attachment 1 of this report) shows the capture zones of the shallow, intermediate, and bedrock water-bearing zones, respectively. Prior to 1986, facility production wells W-1, W-10, and an additional production well, W-2, were pumped to provide process water for the facility since plant production activities began in the 1940s. The capture zone created by the pumping of these production wells provides hydraulic containment of site-related groundwater contamination at the EKCO facility.

In March and April 1994, WESTON performed well rehabilitation interim remedial measures (IRM) activities at the EKCO facility in accordance with the Draft IRM Work Plan approved by EPA in February 1994. This IRM was precipitated by a casing seat test performed on well R-2 in April 1991, which indicated that the casing seal was leaking. The leaking seal allowed groundwater to migrate downward from the overburden water-bearing units, through the annulus around the casing, to the sandstone bedrock water-bearing zone in the open borehole. The results of the RFI suggested that wells R-1, R-3, W-1, W-2, and W-10 may also have acted as conduits from the shallow and intermediate water-bearing units to the bedrock unit.

The results of the well rehabilitation IRM were presented in the *Draft Report, Interim Remedial Measures, EKCO Housewares Facility,* which was submitted to EPA in June 1994. WESTON re-evaluated the findings presented in the CMS based on the results of the well rehabilitation IRM and submitted the results of that re-evaluation as an addendum to the report to the EPA in July 1994.

The EPA issued the Draft Statement of Basis (SB), which explained the proposed remedy for cleaning up the site in April 1996, and presented it at a public meeting in September 1996. In August 2000, the EPA requested that new soil cleanup goals be calculated for the site, using the EPA Soil Screening Guidance (EPA, 1996). The EPA requested that new soil cleanup goals be calculated for the two contaminants, trichloroethene (TCE) and cis-1,2-dichloroethene (1,2-DCE), which were exceeded in the CMS Report, plus two additional contaminants, 1,1-dichloroethene (1,1-DCE) and 1,1,1-trichloroethane (1,1,1-TCA).

In September 2000, WESTON submitted revised soil cleanup goals to the EPA and collected 54 soil samples from 19 soil borings to evaluate current soil contaminant concentrations at the site. In November 2000, WESTON submitted a Draft Soil Investigation Report to the EPA, presenting the results of the September 2000 soil investigation. The EPA provided comments on the report in December 2000, and WESTON completed a Final Soil Investigation Report in February 2001.

The new cleanup goals are significantly lower than the goals presented in the CMS Report. The lower goals could potentially require larger areas of soil remediation. Because 10 years have elapsed since the last soil samples were collected, it is likely that some natural attenuation of site soil contamination has occurred. Due to the new soil cleanup goals for TCE and 1,2-DCE, the addition of two new contaminant goals (TCA and 1,1-DCE) and the significant amount of time that has elapsed since the RFI/CMS soil samples were collected, it was necessary to re-evaluate the findings and recommendations presented in the Final CMS in November 1993 and the First CMS Addendum in July 1994. This report (the Second Addendum to the CMS Report) is being submitted to the EPA to summarize activities that have occurred since the Final CMS Report (November 1993) and to evaluate how these activities affect the findings and recommendations of the CMS. The original and revised cleanup goals and CMS Remedial Action Alternatives are summarized in Section 1 of this report. The September 2000 soil investigation is summarized in Section 2 of this report, and Recommendation of Corrective Measures Alternatives is presented in Section 3 of this report.

1.2 SUMMARY OF CMS FINDINGS AND RECOMMENDATIONS

1.2.1 Soil and Groundwater Cleanup Goals (November 1993)

Soil and groundwater cleanup goals were developed in Section 2 of the CMS Report and are summarized below.

Soil Cleanup Goals

Partition modeling of contaminants found in soil boring samples was performed to calculate soil cleanup goals that would not cause groundwater to exceed maximum contaminant levels (MCLs) under current pumping conditions. Modeling consisted of using the respective contaminant MCL concentration, diluted by the shallow zone aquifer volume, to determine the maximum soil concentration based on equilibrium partitioning between the soil and infiltrating precipitation. Soil cleanup goals calculated by this method were 1.0 and 10.0 mg/kg for TCE and 1,2-DCE, respectively. Soils exceeding these cleanup levels were identified at the four areas shown in Figure 1-1.

Groundwater Cleanup Goals

Contaminants found in site groundwater above their respective MCLs were PCE, TCE, 1,1-DCE, 1,2-DCE, vinyl chloride, and 1,1,1-TCA. Action levels (MCLs) for the contaminants are:

- PCE – 0.005 mg/L
- TCE – 0.005 mg/L
- 1,1-DCE – 0.007 mg/L
- 1,2-DCE (cis isomer) – 0.07 mg/L
- Vinyl chloride – 0.002 mg/L
- 1,1,1-TCA – 0.2 mg/L

1.2.2 Evaluation of Corrective Measures Alternatives

In order to effectively lower site contamination to the soil and groundwater cleanup goals listed above, multiple remedial action alternatives were developed in Section 4 of the CMS Report and in Section 4 of the First Addendum. These soil and groundwater remedial action alternatives are summarized below.

1.2.2.1 Soil Corrective Measures Alternatives

The following corrective measures alternatives were evaluated during the CMS for remediating contaminated soil underneath the building.

- Alternative IS-1 – No Action—Under this alternative, no remedial action would be performed on the soils underneath the building.

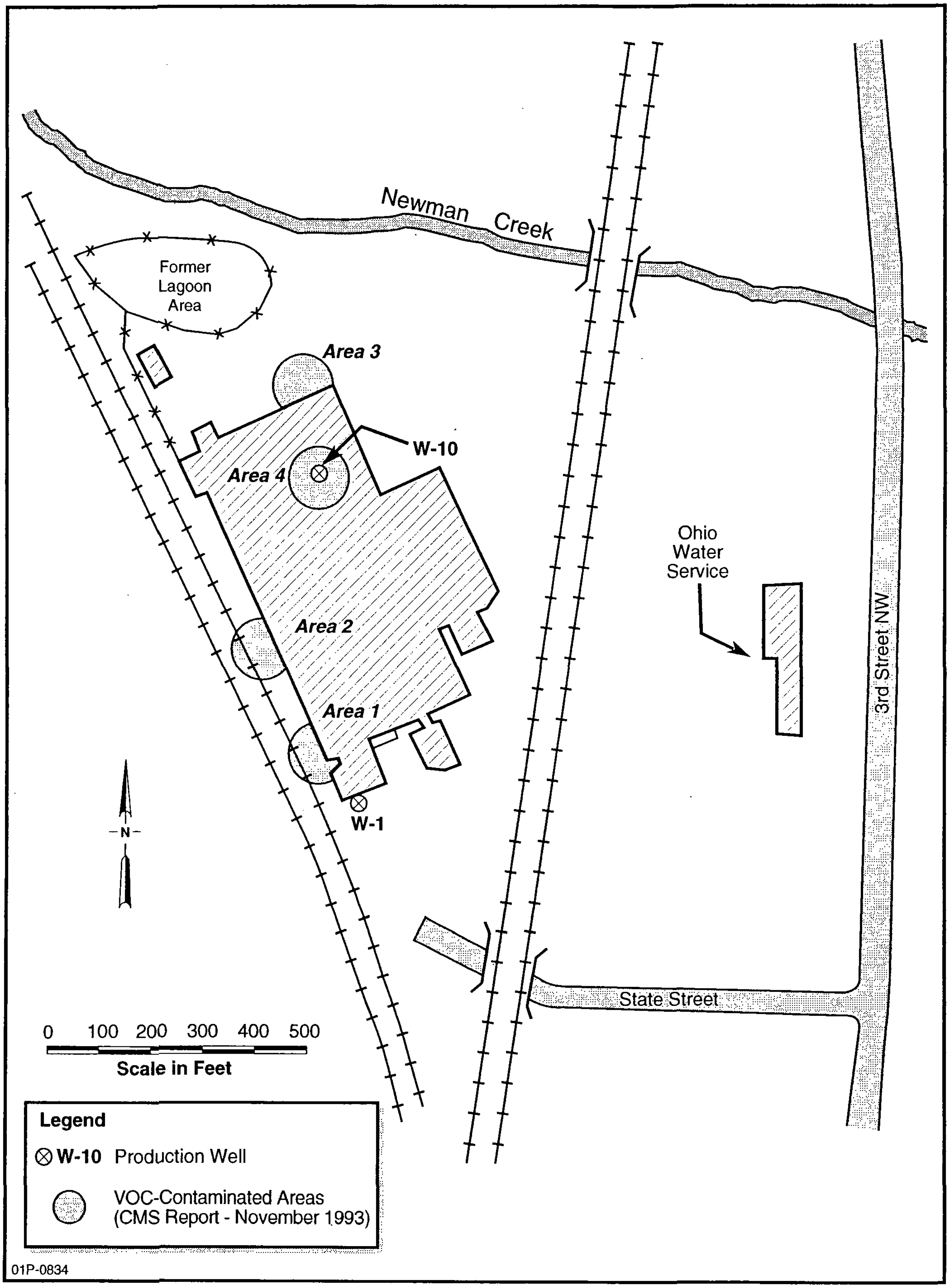

FIGURE 1-1 ORIGINAL VOC-CONTAMINATED AREAS EXCEEDING SOIL CLEANUP GOALS - BASED ON THE 1988 AND 1991 CMS DATA ONLY

- Alternative IS-2 – Soil Vapor Extraction (SVE) Treatment—Under this alternative, an SVE system would be installed to remove VOCs from the soils underneath the building. Air injection vents and vertical recovery vents would be installed through the floor of the building. The removed VOCs would be treated using granular-activated carbon (GAC), if necessary.

- Alternative IS-3 – Horizontal SVE Treatment—Under this alternative an SVE system would be installed to remove VOCs from the soil underneath the building. Air injection vents and recovery vents would be installed from outside the building and run horizontally underneath the building. The removed VOCs would be treated using GAC, if necessary.

The following corrective measures alternatives were evaluated during the CMS for remediating contaminated soil outside the building:

- Alternative OS-1: No Action—Under this alternative, no remedial action would be performed on the soils outside the building.

- Alternative OS-2: Fence and Post Warning Signs—Under this alternative, areas outside the building that have soil contamination exceeding the proposed RCRA corrective action guidelines would be fenced and posted to prevent unauthorized contact.

- Alternative OS-3: SVE—Under this alternative, an SVE system would be installed to remove VOCs from the three areas of soil contamination outside the building. Air injection vents and a combination of vertical and horizontal recovery vents would be installed in each area. The removed VOCs would be treated using GAC, if necessary.

- Alternative OS-4: Ex Situ Volatilization—Under this alternative, the three areas of soil contamination outside the building would be excavated. This soil would be placed on an impervious surface for treatment. The VOCs would be removed through a series of pipes connected to a vacuum pump. The removed VOCs would be treated using GAC, if necessary. Following successful treatment, the soil would be returned to the excavation. Implementation of this approach would require the designation of a corrective action management unit (CAMU) at the facility.

- Alternative OS-5: Low Temperature Thermal Treatment—Under this alternative, the three areas of soil contamination outside the building would be excavated. This soil would be pretreated to remove any large debris. The soil would then be conveyed into the thermal treatment unit. The removed VOCs would be treated using GAC. Following successful treatment, the soil would be returned to the excavation. Implementation of this approach would require the designation of a CAMU at the facility.

- Alternative OS-6: Off-Site Disposal/Incineration—Under this alternative, the three areas of soil contamination outside the building would be excavated. This soil would be sent to either a hazardous waste landfill or an incinerator, depending on whether the excavated soil meets the land disposal restrictions (LDRs).

1.2.2.2 Groundwater Corrective Measures Alternatives

The following corrective measures were evaluated during the CMS for remediating groundwater:

- Alternative GW-1: No Action—With the no action alternative, the current groundwater recovery operation would cease. Site groundwater would be uncontrolled. No groundwater monitoring would be performed.

- Alternative GW-2: Installation of Additional Recovery Wells—Operation of the existing recovery wells, W-1 and W-10, would continue. An additional two recovery wells would be used to control groundwater in the shallow and intermediate water-bearing zones. The existing air stripper would be used to treat the recovered groundwater. Groundwater monitoring would be continued on a semi-annual basis. Wells not required for monitoring would be grouted/sealed.

- Alternative GW-3: Installation of Additional Recovery Wells and Pulse Pumping of Bedrock Wells—Three additional recovery wells would be used to control groundwater in the shallow and intermediate water-bearing zones. Operation of the existing recovery system would be modified so that each of the recovery wells, W-1 and W-10, would be operated on an alternating (pulsed) basis. The average flow rate of the system would be reduced, and higher VOC removal rates predicted. The object would be to increase the overall mass flow rate (i.e., pounds per year) of VOCs removed. The existing air stripper would be used to treat the recovered groundwater. Groundwater monitoring would be performed on a semi-annual basis. Wells not required for groundwater monitoring would be grouted/sealed.

- Alternative GW-4: Pulse Pumping—Operation of the existing recovery system would be modified so that each of the recovery wells, W-1 and W-10, would be operated on an alternating (pulsed) basis. The average flow rate of the system would be reduced, and higher VOC removal rates predicted. The object would be to increase the overall mass flow rate (i.e., pounds per year) of VOCs removed. The existing air stripper would be used to treat the recovered groundwater. Groundwater monitoring would be performed on a semi-annual basis. Wells not required for groundwater monitoring would be grouted/sealed.

- Alternative GW-5: Use of Overburden Recovery Wells and Pulse Pumping of Bedrock Wells—Additional recovery wells would be used to enhance groundwater recovery in the shallow and intermediate water-bearing zones in the area north of the building. These wells would concentrate removal of groundwater with the highest level of VOCs. Operation of the existing recovery system would be modified so that each of the recovery wells, W-1 and W-10, would be operated on an alternating (pulsed) basis. The average flow rate of the system would be reduced, and higher VOC removal rates predicted. The object would be to increase the overall mass flow rate (i.e., pounds per year) of VOCs removed. The existing air stripper would be used to treat the recovered groundwater. Groundwater monitoring would be performed on a semi-annual basis. Wells not required for groundwater monitoring would be grouted/sealed.

- Alternative GW-6: Air Sparging of Overburden and Pulse Pumping of Bedrock Wells—An air sparging system would be installed in the vicinity of well D-4-30. Air sparging would be used to remediate the area of highest groundwater contamination. Operation of the existing recovery system would be modified so that each of the recovery wells, W-1 and W-10, would be operated on an alternating (pulsed) basis. The average flow rate of the system would be reduced, and higher VOC removal rates predicted. The object would be to increase the overall mass flow rate (i.e., pounds per year) of VOCs removed. The existing air stripper would be used to treat the recovered groundwater. Groundwater monitoring would be performed on a semi-annual basis. Wells not required for groundwater monitoring would be grouted/sealed.

1.2.3 Recommendations of Corrective Measures Alternatives

1.2.3.1 Soil Corrective Measures Alternatives

Three alternatives for remediating soils underneath the building were developed for detailed analysis during the CMS. Alternative IS-1 (No Action) does not meet the corrective measures objectives for soils, whereas alternatives IS-2 (Vertical SVE) and IS-3 (Horizontal SVE) would both meet the objectives. Alternatives IS-2 and IS-3 meet the corrective measures objectives in functionally the same manner. With alternative IS-2, vents would be installed from within the building, through the floor. With alternative IS-3, the vents would be installed from outside the building. IS-3 is expected to have less potential impact on the facility operations, but IS-2 is more cost-effective. Therefore, it was recommended in the CMS that alternative IS-2 be implemented.

Six alternatives for remediating soils outside the building were developed for detailed analysis during the CMS.

Alternatives OS-1 and OS-2 do not meet the corrective measures objectives, whereas the remaining alternatives do meet the objectives. Alternatives OS-3, OS-4, OS-5, and OS-6 (with incineration as the disposal option) act to reduce the volume of contaminated material, but alternative OS-6 (with landfill as the disposal option) achieves no reduction of either waste volume or soil toxicity. Alternatives OS-4, OS-5, and OS-6 all require excavation of the soils, which could potentially volatilize the VOCs in the soils. Additionally, if soil contamination in Areas 1, 2, or 3 extends to and/or underneath the building, the alternatives that involve excavation would become difficult to fully implement and would require SVE. SVE is already the recommended alternative for Area 4 soils underneath the building and could be implemented in Areas 1, 2, and 3, if necessary. SVE is also a well proven technology for VOC-contaminated soils.

Based on these considerations, alternative OS-3 was recommended for soils outside the building in the CMS.

1.2.3.2 Groundwater Corrective Measures Alternatives

Six alternatives for groundwater were developed for detailed analysis. Alternative GW-1 (No Action) does not meet the corrective measures objectives for groundwater. Alternatives GW-2 (Installation of Additional Recovery Wells and Constant Pumping of Wells W-1 and W-10) and GW-3 (Installation of Additional Overburden Recovery Wells and Pulse-Pumping of Wells W-1 and W-10) were developed given the assumption that additional recovery wells were necessary to maintain hydraulic control of the shallow and intermediate water-bearing zones following well rehabilitation IRM activities. As discussed in Section 2 of the First Addendum (July 1994), hydraulic control of the shallow, intermediate, and bedrock water-bearing units has been maintained by the pumping of wells W-1 and W-10.

Alternatives GW-2, GW-3, GW-4, GW-5, and GW-6 all meet the corrective measures objectives in functionally the same manner. Each would control the shallow, intermediate, and bedrock water-bearing zones using recovery wells W-1 and W-10. Alternatives GW-3, GW-4, GW-5, and GW-6 refine this approach by incorporating pulse pumping of the bedrock recovery wells. The existing data suggest that pulse pumping may serve to increase the level of VOCs in the recovered groundwater. This in turn may lead to a reduction in the time required to reduce site groundwater to regulatory standards. Alternative GW-2, which does not include pulse pumping, therefore, was not recommended.

With alternative GW-6, air sparging would be used to reduce VOC levels in the shallow water-bearing zone. Alternative GW-6 requires that soils alternative OS-3 (SVE operation) be selected and that the SVE system be operated in Area 3 (shown in Figure 1-2), north of the EKCO building. Based on these considerations and the data available at the time, alternative GW-6 was recommended in the First CMS Addendum (July 1994).

In summary, soil and groundwater corrective measures alternatives recommended in the CMS (November 1993) and the First Addendum (July 1994) were:

- Soil beneath the building: Vertical SVE (IS-2).
- Soil outside the building: Vertical SVE (OS-3).
- Groundwater: Pulse Pumping Recovery Wells W-1 and W-2, and Air Sparging in Area 3 (GW-6).

1.3 REVISED SOIL CLEANUP GOALS (SEPTEMBER 2000)

Subsurface soil sampling at the site was performed in November 1988 and September 1991. The results obtained from these soil investigations showed that trichloroethylene (TCE) and 1,2-dichloroethene (1,2-DCE) were the only contaminants that exceeded the site-specific cleanup goals recommended in the CMS report. At the request of the U.S. EPA in a letter dated 4 August 2000, these cleanup goals were recalculated using a more recent method presented in the EPA Soil Screening Guidance (EPA, April 1996). The soil calculations are provided in Attachment 2. The recalculated Soil Screening Level (SSL) cleanup goals, presented to U.S. EPA by letter dated 6 September 2000, and the U.S. EPA Region 5 industrial soil preliminary remediation goals (PRGs) are as follows:

Contaminant	November 1993 CMS Report (μg/kg)	September 2000 Soil Screening Level (SSL) (μg/kg)	Industrial Preliminary Remediation Goal (PRG) (μg/kg)
Trichloroethylene (TCE)	1,000	230	6,100
1,2-Dichloroethene (1,2-DCE)	10,000	1,500	150,000
1,1-Dichloroethene (1,1-DCE)	—	120	120
1,1,1-Trichloroethane (1,1,1-TCA)	—	6,140	1,400,000

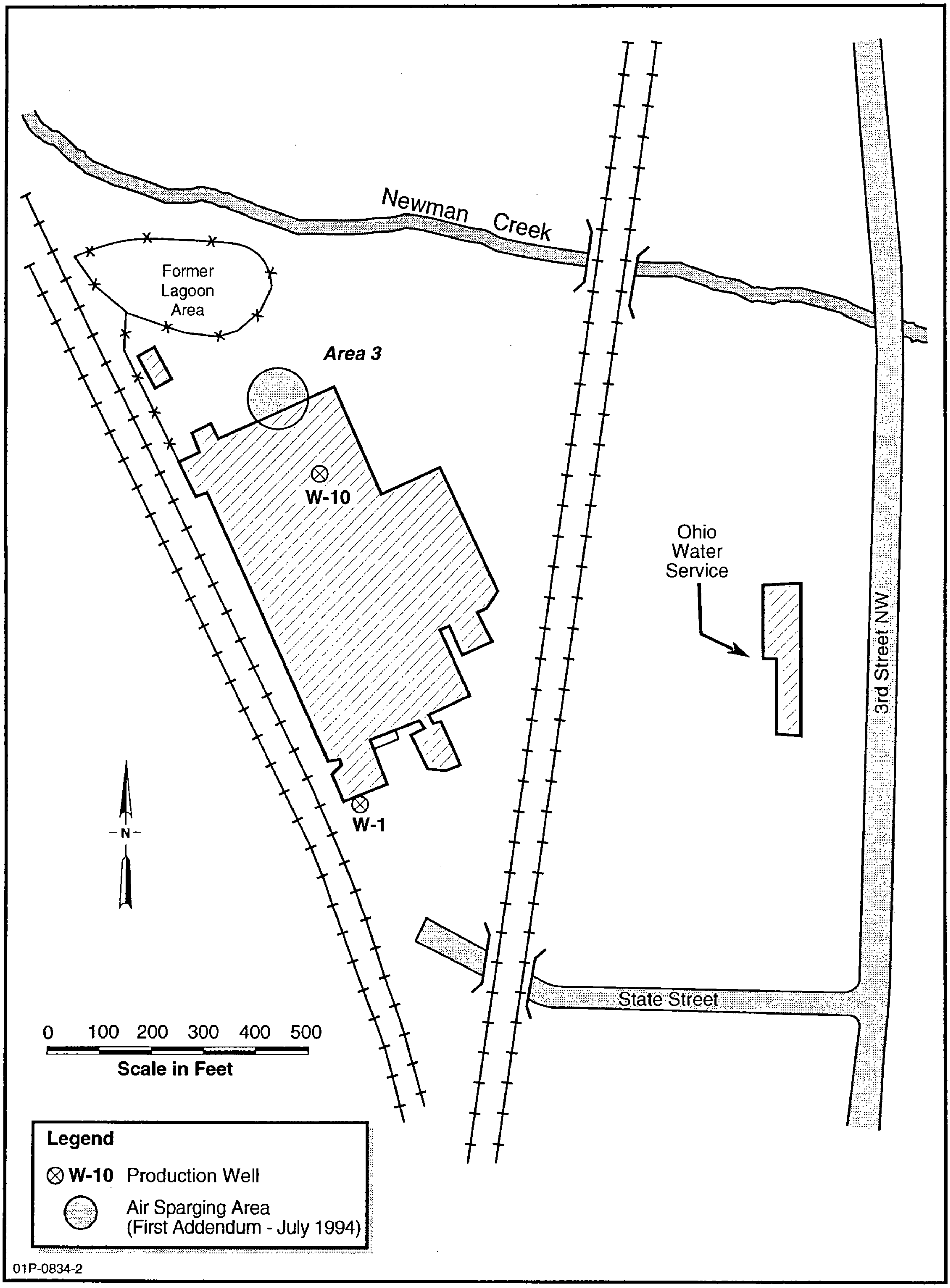

FIGURE 1-2 PROPOSED AIR SPARGING AREA BASED ON THE 1988 AND 1991 CMS DATA ONLY

The new SSL soil remediation goals listed above are currently being used to evaluate and recommend soil remediation alternatives for the site. However, EKCO does not waive its right to contest the applicability of these levels to the site at a later date.

2. SEPTEMBER 2000 SOIL INVESTIGATION

The most recent subsurface soil sampling program was performed at the EKCO facility on 20 through 22 September 2000. Because nine years had passed since the previous soil sampling program was completed, it was anticipated that the concentrations of target VOCs at the site might have decreased due to natural attenuation. Therefore, it was decided that additional subsurface soil sampling was necessary to both confirm and delineate the extent of target VOCs in the proposed remediation areas. The target VOCs for this investigation include TCE, 1,2-DCE, 1,1-DCE, and 1,1,1-TCA. These soil sampling activities and results are presented in the Soil Investigation Report (February 2001) and summarized below. The *February 2001 Soil Investigation Report* minus laboratory data packages is provided in Attachment 1.

Fifty-two soil samples were collected at 19 soil boring locations. The soil boring locations were selected on the basis of results obtained from previous borings drilled in 1988 and 1991, and also on requests made by the U.S. EPA. Initially, 18 boring locations were selected for sampling during this investigation; however, one boring was added during the field investigation based on laboratory results obtained from an adjacent boring.

Soil sampling and analysis activities were conducted in accordance with the Standard Operating Procedures included in the Quality Assurance Project Plan Addendum submitted to the U.S. EPA on 6 September 2000. The soil borings were drilled using a truck-mounted Geoprobe® machine operated by the subcontractor, Frontz Drilling Company, Inc., who performed all drilling activities under the direct supervision of a WESTON geologist. All boring locations were cleared for underground utilities by an on-site EKCO representative.

At boring locations inside the EKCO building, a cement corer was used to drill through the concrete floor prior to Geoprobe® drilling. The Geoprobe® uses a direct-push percussion drilling technique to advance a core barrel containing a 4-foot long dedicated acetate liner. The acetate liner is used to obtain continuous cores of the subsurface soils over a 4-foot interval unless refusal or some other type of obstruction prohibits sample collection. After advancing the core barrel through each interval, the acetate liner was removed from inside the core barrel and cut open. Immediately after cutting the liner open, an organic vapor meter (OVM) was used to scan the sample to assess the presence of organic compounds in the soil. After quickly scanning the recovered soil with an OVM, the interval with the highest OVM reading was immediately sampled using an EnCore®sampler. For intervals where no elevated OVM readings were recorded, samples were collected where a lithologic change occurred or where possible soil staining was observed.

The Geoprobe® borings were advanced and soil samples were collected until either refusal, the water table, or all OVM readings recorded at or below 12 ft bgs were below background levels, whichever was encountered first. The depths of the Geoprobe® borings varied between 7 and 19.8 ft bgs across the site. Two to five samples were collected from each soil boring depending on the total depth of the boring and field screening results. Samples were delivered at the end of each day to Aqua Tech Environmental Laboratories in Marion, Ohio. The samples were analyzed using Method 5035 in conjunction with Method 8260B within 24 hours of sample collection. Where reanalysis of samples was required, the reanalysis occurred within 48 hours of sample collection.

An examination of the analytical results reveals that TCE is the most prevalent contaminant at the site detected at concentrations above the new SSLs calculated in September 2000. The highest concentrations of TCE were detected in the soils inside the building in the vicinity of a TCE spill that reportedly occurred between 1979 and 1980 near well W-10. The breakdown products of TCE are also present at some locations in this area. At locations where concentrations of the breakdown products of TCE exceeded SSLs, TCE was also detected at concentrations above its SSL.

The following conclusions can be made based on soil sampling data collected at the site in 1988, 1991, and 2000:

- Soil contaminant concentrations have decreased below SSLs north of the plant manufacturing building (CMS Area 3) and soil remediation is no longer needed in that area (Figure 1-1).
- Soil contaminant concentrations have generally increased beneath the building (CMS Area 4) in the vicinity of the former TCE spill. Increased VOC concentrations may be a reflection of the new soils sampling method (5035) used which is expected to provide a more representative assessment of the actual contaminant conditions in soil.

- Soil concentrations of TCE along the southwest corner (CMS Area 1) and west side (CMS Area 2) of the building are generally the same or have decreased.
- Soil concentrations of TCE in the area, approximately 150 feet east of the northeast corner of the building ("Area 3-East") have increased and soil remediation is needed in that area (Figure 1-3).
- The SSL soil cleanup goals for addressing groundwater contamination are currently exceeded in four areas: CMS Areas 1, 2, and 4, and the new Area 3 East.
- Industrial soil PRGs are exceeded for TCE and 1,1-DCE (Area 4). Since the industrial PRGs are equal to or greater than the SSLs, remediation efforts designed to achieve the SSLs will adequately address the PRGs.

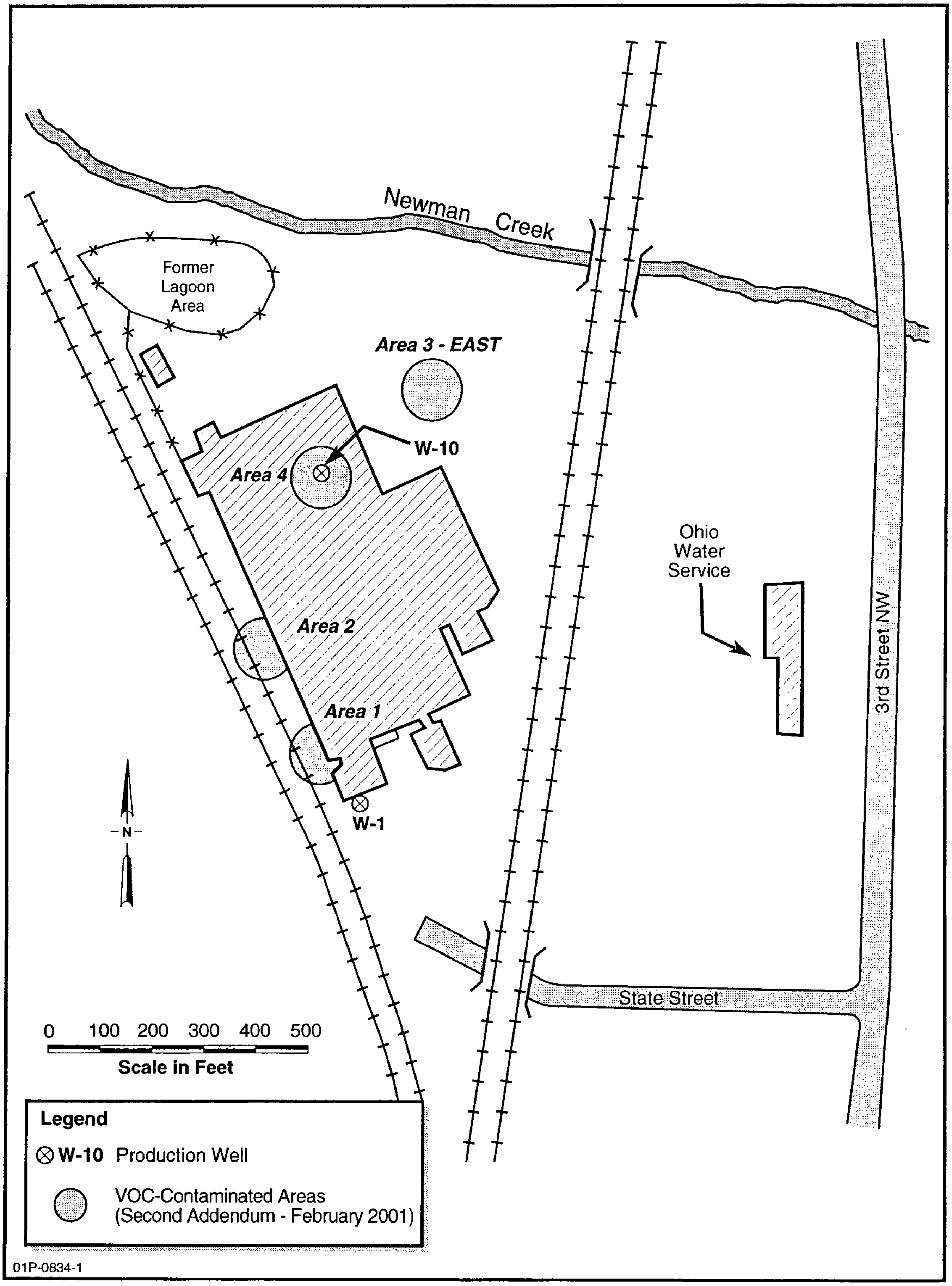

FIGURE 2-1 REVISED VOC-CONTAMINATED AREAS EXCEEDING SOIL CLEANUP GOALS - BASED ON THE 1988, 1991 AND 2000 SOIL BORING DATA

3. RECOMMENDATION OF CORRECTIVE MEASURES ALTERNATIVES

The following soil and groundwater remediation recommendations are based on data presented in the Final CMS Report (November 1993), the First Addendum (July 1994), and the Soil Investigation Report (February 2001).

3.1 RECOMMENDED CORRECTIVE MEASURES ALTERNATIVES FOR SOIL

The September 2000 soil sampling results are similar to, but not exactly the same as, previously identified in the CMS Report. Therefore, the soil vapor extraction corrective measures alternatives IS-2 and OS-3 can be retained as the preferred soil remediation alternatives on the site. The only changes are that Area 3 should be deleted because that area is now clean, and Area 3-East needs to be added, because it exceeds the new SSL cleanup goals. The general areas which currently exceed the new SSL soil cleanup goals are shown in Figure 2-1.

3.2 RECOMMENDED CORRECTIVE ACTION MEASURES ALTERNATIVES FOR GROUNDWATER

The September 2000 soil sampling results indicate that the soil in the area north of the plant building (Area 3) no longer exceeds soil cleanup goals and, therefore, no SVE soil remediation is needed in that area.

The groundwater corrective measures alternatives recommended in the First Addendum was GW-6 and consisted of pulse pumping wells W-1 and W-10 plus air sparging in Area 3. The air sparging proposed for Area 3 requires that SVE also be done in that area, and since SVE is no longer needed in that area, it is no longer appropriate to implement air sparging in Area 3. The First Addendum also shows that wells W-1 and W-10 completely capture groundwater in the shallow, intermediate and bedrock water-bearing units which exist on site, and that no additional shallow groundwater recovery wells are needed to capture the site groundwater plume (see Figures 1, 2, and 3 in the attached *February 2001 Soil Investigation Report*). Based on these findings it is recommended that alternative GW-6 be replaced with alternative GW-4, which consists of pulse pumping recovery wells W-1 and W-10, but excludes air sparging in Area 3. As discussed in Section 1 of this report and Section 6 of the First Addendum, GW-4 meets the corrective measures objectives in functionally the same manner as GW-6 and it is more appropriate in light of the more recent soil sampling and hydraulic data.

In summary, soil and groundwater corrective measures alternatives recommended at this time are:

- Soil beneath the building: Vertical SVE (IS-2)
- Soil outside the building: Vertical SVE (OS-3)
- Groundwater: Pulse pumping recovery wells W-1 and W-2 (GW-4)

These corrective measures alternatives meet the corrective measures objectives and incorporate the more recent soil sampling and hydraulic data that have been collected since the CMS and First Addendum were written in November 1993 and July 1994, respectively.

ATTACHMENT 1
FEBRUARY 2001 SOIL INVESTIGATION REPORT
(without laboratory data packages)

FINAL
SOIL INVESTIGATION REPORT
for the
EKCO World Kitchen Facility
Massillon, Ohio

U.S. EPA ID #OHD 045-205-424

Prepared for

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February 2001

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INTRODUCTION

This report summarizes the results of three subsurface soil investigations that were performed in 1988, 1991, and, most recently, in September 2000 at the EKCO Housewares, Inc. – World Kitchen (EKCO) facility in Massillon, Ohio. The 1988 and 1991 subsurface soils investigations were performed in response to an Administrative Consent Order entered into between EKCO and the United States Environmental Protection Agency (U.S. EPA) in 1987. Nine years had passed since the previous soil sampling program was completed, and it was anticipated that the concentrations of target VOCs at the site might have decreased due to natural attenuation. Therefore, with U.S. EPA approval, it was elected that additional subsurface soil sampling would be performed to confirm and delineate the extent of target VOCs in the proposed remediation areas.

A RCRA Feasibility Investigation/Corrective Measures Study (RFI/CMS) was conducted in the early 1990s and was approved in November 1993. The RFI/CMS included the results of an extensive assessment of soil and groundwater conditions performed at the EKCO facility. A proposed Statement of Basis (SB), which incorporated the remedial alternatives recommended in the RFI/CMS report, was issued in April 1996. The proposed Statement of Basis provides the proposed selected remedy for groundwater, the proposed remedy for soils underneath the building, and the proposed selected remedy for soils outside the building that contained elevated levels of VOCs.

The primary component of the proposed selected groundwater remedial alternative presented in the CMS and the proposed SB is a groundwater pump-and-treat program utilizing on-site production wells W-1 and W-10. EKCO has been operating a pump and treat system with these wells since an air stripper was installed in 1986. An examination of groundwater elevation data collected from site monitor and pumping wells shows that the capture zone for the two currently pumping production wells (W-1 and W-10) extends well beyond the EKCO property. The groundwater contour maps for February 1999 are included in Appendix 1. Prior to 1986, facility production wells W-1, W-10, and an additional production well, W-2, were pumped to provide process water for the facility since plant production activities began in the 1940s. The capture zone created by the pumping of these production wells provides hydraulic containment of site-related groundwater contamination at the EKCO facility.

The proposed remedial alternative selected for treating on-site soils with elevated levels of VOCs is soil vapor extraction (SVE). Soil sampling programs completed as part of the RFI/CMS in 1988 and 1991 identified four areas where SVE systems may be necessary (see map in Appendix 2). An additional subsurface soil sampling program was performed in September 2000 at the EKCO facility. The locations of all of the soil borings completed in 1988, 1999, and 2000 are shown on Figure 1. A discussion of this soil sampling program and results is presented in the following sections.

1988 AND 1991 SOIL SAMPLING RESULTS

Previous subsurface soil sampling at the site was performed in November 1988 and September 1991. The results obtained from these soil investigations showed that trichloroethylene (TCE) and 1,2-dichloroethene (1,2-DCE) were the only contaminants that exceeded the site-specific cleanup goals recommended in the CMS report. At the request of the U.S. EPA in a letter dated 4 August 2000, these cleanup goals were recalculated using a more recent method presented in the EPA Soil Screening Guidance (EPA, April 1996). The recalculated soil cleanup goals, presented to U.S. EPA by letter dated 6 September 2000, and the U.S. EPA Region 5 industrial soil preliminary remediation goals (PRGs) are as follows:

Contaminant	November 1993 CMS Report (μg/kg)	September 2000 Soil Screening Level (SSL) (μg/Kg)	Industrial Preliminary Remediation Goal (PRG) (μg/kg)
Trichloroethylene (TCE)	1,000	230	6,100
1,2-Dichloroethene (1,2-DCE)	10,000	1,500	150,000
1,1-Dichloroethene (1,1-DCE)	—	120	120
1,1,1-Trichloroethane (1,1,1-TCA)	—	6,140	1,400,000

The new SSL soil remediation goals listed above are currently being used to evaluate soil remediation alternatives for the site. However, EKCO does not waive its right to contest the applicability of these levels to the site at a later date.

During the November 1988 soil sampling program, soil samples were collected at 14 locations at depths between 2 and 12 feet below ground surface (ft bgs). During the September 1991 soil sampling program, soil samples were collected at 11 locations at depths between 0 and 12 ft bgs. All soil borings during these investigations were drilled using hollow-stem drilling techniques and samples were collected from a decontaminated split-spoon sampler. Each boring was drilled and sampled to a total depth of 12 ft bgs, refusal, or the water table, whichever occurred first.

The locations of the borings drilled during the 1988 and 1991 programs and the analytical results for TCE, 1,2-DCE, 1,1-DCE, and 1,1,1-TCA are shown in Figures 2, 3, 4, and 5, respectively. Comparing these results to the newly calculated soil cleanup goals, exceedances for TCE were noted at seven locations. There was one exceedance of 1,2-DCE and two exceedances of 1,1-DCE. There were no exceedances of 1,1,1-TCA. The location of areas recommended for soil remediation, as presented in the proposed SB in September 1996, was based on the locations of exceedances of the original soil cleanup goals (see map in Appendix 2). These areas include:

- The tank area at the southwestern area of the plant.
- The northern end of building at production well W-10.
- The tank area at the northern end of the plant.
- The tank area at the western area of the plant.

Finalization of the SB was expected in late 1996 as a result of the public meeting and completed public comment period. In discussions with the U.S. EPA and OEPA, at a site meeting on 29 February 2000, additional soil sampling was discussed in order to further delineate the proposed areas for remediation. U.S. EPA approved the soil sampling plan by letter dated 15 September 2000.

2000 SOIL SAMPLING PROCEDURES

The most recent subsurface soil sampling program was performed at the EKCO facility on 20 through 22 September 2000. Since 9 years had passed since the previous soil sampling program was completed, it was anticipated that the concentrations of target VOCs at the site might have decreased due to natural attenuation. Therefore, it was decided that additional subsurface soil sampling was necessary to both confirm and delineate the extent of target VOCs in the proposed remediation areas. The target VOCs at the EKCO site include TCE, 1,2-DCE, 1,1-DCE, and 1,1,1-TCA. The soil sampling results obtained from this investigation are presented below.

Soil borings were completed at the 19 locations shown in Figure 1. The soil boring locations were selected on the basis of results obtained from previous borings drilled in 1988 and 1991, and also on requests made by the U.S. EPA. Initially, 18 boring locations were selected for sampling during this investigation; however, one additional boring (SB-19-00) was added during the field investigation based on laboratory results obtained from an adjacent boring (SB-02-00).

Soil sampling and analysis activities were conducted in accordance with the Standard Operating Procedures included in the Quality Assurance Project Plan Addendum submitted to the U.S. EPA on 6 September 2000. The soil borings were drilled using a truck-mounted Geoprobe® machine operated by a subcontractor, Frontz Drilling Company, Inc., who performed all drilling activities under the direct supervision of a WESTON geologist. All boring locations were cleared for underground utilities by an on-site EKCO representative. Two boring locations on the west side of the building were offset by several feet from their original location due to the proximity of a storm sewer on that side of the building. In addition, soil boring SB-12-00, located inside the building, was moved approximately 15 feet from its original location, which was coincident with boring SB-11-91 that was drilled during the soil boring program in 1991. A newly constructed office within the EKCO plant in this area obstructed access to the exact location of the previous boring.

At boring locations inside the EKCO building, a cement corer was used to drill through the concrete floor prior to Geoprobe® drilling. The Geoprobe® uses a direct-push percussion drilling technique to advance a core barrel containing a 4-foot long dedicated acetate liner. The acetate liner is used to obtain continuous cores of the subsurface soils over a 4-foot interval unless refusal or some other type of obstruction prohibits sample collection. After advancing the core barrel through each interval, the acetate liner was removed from inside the core barrel and cut open. Immediately after cutting the liner open, an organic vapor meter (OVM) was used to scan the sample to assess the presence of organic compounds in the soil. After quickly scanning the recovered soil with an OVM, the interval with the highest OVM reading was immediately sampled using an EnCore®sampler. For intervals where no elevated OVM readings were recorded, samples were collected where a lithologic change occurred or where possible soil staining was observed.

The Geoprobe® borings were advanced and soil samples were collected until either refusal, the water table, or all OVM readings recorded below background levels at or below 12 ft bgs, whichever was encountered first. The depths of the Geoprobe® borings varied between 7 and 19.8 ft bgs across the site. Two to five samples were collected from each soil boring depending on the total depth of the boring and field screening results. All downhole equipment used by the Geoprobe® rig was decontaminated between boring locations. After the completion of each boring, the borehole was backfilled to existing ground surface with bentonite. The locations inside the building were backfilled with bentonite to the bottom of the cement floor and then finished off to grade with cement. A lithologic description was completed after all samples had been collected from a given boring location. The complete soil boring logs are included as Appendix 3.

Immediately following sample collection, the EnCore® sample containers were placed in ice filled coolers and the sample identification was recorded on a laboratory chain-of-custody form. Additional quality assurance/quality control (QA/QC) soil and water samples were submitted to the laboratory. The following QA/QC samples were collected:

- Duplicate samples collected at a frequency of 10% or one for every 10 soil samples.
- A laboratory MS/MSD collected at a rate of one for every 20 soil samples.
- Trip blank included with every lab shipment.
- Field blank collected on a daily basis by pouring distilled water through an acetate liner into preserved laboratory bottles.

Samples were delivered at the end of each day to Aqua Tech Environmental Laboratories in Marion, Ohio. The samples were analyzed using Method 5035 in conjunction with Method 8260B within 24 hours of sample collection. Where reanalysis of samples was required, the reanalysis occurred within 48 hours of sample collection.

SOIL SAMPLING RESULTS

For the purpose of discussing the soil sampling results, the EKCO site is divided into four areas. As shown on Figure 1, these areas are the North Area-Outside, North Area-Inside, West Area, and Southwest Area. A summary of the September 2000 analytical results, and the results of the QA/QC samples are presented in Tables 1 through 5. The complete analytical data package is included as Appendix 4.

Figures 6, 7, 8, and 9 show the areal distribution of TCE, 1,2-DCE, 1,1-DCE and 1,1,1-TCA, respectively. An examination of the analytical results shown in these figures reveals that TCE is the most prevalent contaminant at the site detected at concentrations above SSLs. The highest concentrations of TCE were detected in the soils inside the building in the vicinity of a TCE spill that reportedly occurred between 1979 and 1980. The breakdown products of TCE are also present at some locations in this area. At locations where concentrations of the breakdown products of TCE exceeded SSLs, TCE was also detected at concentrations above its SSL. At the three locations where 1,1,1-TCA was detected above its calculated SSL, only boring location SB-10-00 contained TCE at concentrations below its SSL.

A three-dimensional (3-D) model was developed using earthVision, which is a powerful 3-D geospatial modeling tool that is very useful for evaluating and designing groundwater and soil remediation systems. The 3-D model was developed using the September 2000 TCE data and will be used to design an SVE system in areas where it is determined to be necessary. The extent of September 2000 TCE concentrations exceeding the new (230 μg/Kg) and old (1,000 μg/Kg) TCE soil cleanup goals is shown in Figures 10 and 11, respectively. The model will be used to calculate the estimated volumes and mass of contaminated soil needing treatment and to optimally locate SVE vents. The distribution of contamination in each designated area is discussed in the following sections.

North Area—Outside

During the three subsurface soil sampling events, soil samples were collected at five soil boring locations northeast of the EKCO facility. Exceedances above site soil cleanup levels (SSL) were detected at locations SB-01-00 (formerly SB-09-88) and SB-02-00 (formerly SB-04-91). The exceedance at boring location SB-01-00 was at 2.5 ft bgs and only slightly above the SSL for TCE. An additional boring (SB-19-00) was added west of SB-02-00 during the field investigation to further delineate soil conditions in this area. The analytical results for SB-19-00 showed no target compounds above laboratory quantitation limits. No borings were completed to the east of SB-02-00 due to the slope of the ground surface and the presence of the levee in this area.

Northwest of the EKCO facility, subsurface soil samples have been collected at nine locations. TCE concentrations were detected above SSLs at three boring locations sampled in 1988 (SB-06-88, SB-07-88, and SB-08-88). The soils at locations SB-07-88 and SB-08-88 were resampled at similar depths during the September 2000 investigation at locations SB-05-00 and SB-03-00, respectively. Additional soil samples were collected in this area during the September 2000 investigation at locations SB-04-00 and SB06-00. The analytical results obtained from the soil samples collected at all four 2000 soil boring locations showed that TCE concentrations have decreased in this area since 1988 and are now below SSLs. These data show that TCE is naturally attenuating in the soils in this area.

North Area—Inside

Subsurface soil samples were collected at seven locations inside the northern area of the EKCO building. The September 2000 analytical results showed that TCE, 1,1-DCE, 1,2-DCE, and 1,1,1-TCA are present above SSLs. Although it is not evident on any of the figures, all borings were drilled within a single aisle inside the northern end of the building during the September 2000 program. The configuration of shelving limits access for a drilling rig in this area of the building. The source for contamination in this area is presumed to be a TCE spill that occurred between 1979 and 1980 in the vicinity of production well W-10. Well W-10 is located below the plant floor and is covered by a grate that is mounted flush with the plant floor. It is believed that the TCE spill flowed through the grate and into the subsurface vault surrounding the well.

West Area

In the western area outside the EKCO facility, soil samples were collected along a small access road at five boring locations. The analytical results show that concentrations of TCE were above

SSLs for soil samples collected at boring locations SB-16-00 and SB-17-00. No exceedances were observed in the soil sample collected from boring location SB-15-00 that was just to the south of SB-16-00. Sampling location SB-16-00 was drilled at the former location of SB-11-88. The analytical results for SB-16-00 show that TCE concentrations have decreased in the time period since soil samples were collected at SB-11-88; however, the concentrations are still above the SSLs for TCE. To the north of SB-17-00, TCE was detected slightly above the SSL at boring location SB-18-00 in the sample collected at 2.5 ft bgs. No additional soil sampling could be performed in this area since railroad tracks border the access road to the west, and the EKCO building borders to the east. Sampling is not feasible beneath the building in this area as it is the primary manufacturing area for the EKCO facility.

Southwest Area

Inside and outside the southwest corner of the EKCO building, soil samples were collected at seven locations. Samples collected at borings SB-08-00 and SB-09-00 confirmed analytical results for previous borings completed in this area showing that TCE exceeds SSLs. In addition, the results for SB-09-00 showed that 1,2-DCE concentrations were above SSLs. Inside the EKCO building in this area, 1,1,1-TCA was present at a concentration slightly above the SSL at boring location SB-10-00.

CONCLUSIONS

- Soil contaminant concentrations have decreased below SSLs north of the plant manufacturing building (North Area – Outside) and soil remediation is no longer needed in that area.
- Soil concentrations of TCE, 1,1-DCE, 1,2-DCE, and 1,1,1-TCA have generally increased beneath the building (North Area – Inside) in the vicinity of the former TCE spill. Increased concentrations may be a reflection of the new VOCs in soils sampling method (5035) used which is expected to be more representative of the actual contaminant conditions in soil.
- Soil concentrations of TCE along the west side (West Area) and southwest corner (Southwest Area) of the building are generally the same or have decreased.
- Soil concentrations of TCE in the vicinity of SB-01-00 and SB-02-00, located approximately 150 feet east of the northeast corner of the building have increased. The source of contamination in this area is not known.

- The SSL soil cleanup goals for addressing groundwater contamination are currently exceeded in four areas: 1) North Area – Inside; 2) West Area; 3) Southwest Area; and 4) the Northeast Area. These areas are similar to but not exactly the same as previously identified in the CMS (see Appendix 2, Figure 5-3 of the report). Soil vapor extraction may be effective in these areas to remediate soils and expedite the cleanup of groundwater.
- Industrial soil PRGs are exceeded for TCE and 1,1-DCE under the building (North Area – Inside) and for TCE in the West, Southwest, and Northeast Areas. Since the industrial PRGs are equal to or greater than the SSLs, remediation efforts designed to achieve the SSLs will adequately address the PRGs.

REFERENCES

Soil Screening Guidance: User Guide. OSWER Publication 9355.4-23; April 1996.

Determining Soil Response Action Levels Based on Potential Contaminant Migration to Ground Water: A Compendium of Examples. EPA/540/2-89/057, October 1989.

Soil Screening Guidance: Technical Background Document. EPA/54/OR-95/128; May 1996.

Table 1
North Area - Outside
September 2000 Geoprobe Soil Sampling Results (µg/kg)
EKCO World Kitchen, Massillon, Ohio, Facility

Laboratory ID Number:	14298	14299	14300	14301	14302	14303	14461	14462	14463
Soil Boring Number:	SB-01			SB-02			SB-19		
Sample Depth (ft bgs):	2	6	10	2	7	7 (DUP)	3	3 (DUP)	6
Multiplier:	*10*	1	1	189	132	27	1	1	1
COMPOUND									
Trichloroethene	**350**	<R.L.	<R.L.	**30,100**	**19,100**	**5,200**	<R.L.	<R.L.	<R.L.
1,1-Dichloroethene	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.
cis-1,2-Dichloroethene	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.
trans-1,2-Dichloroethene	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.
1,1,1-Trichloroethane	870	<R.L.	210	2,200	1,300	320	<R.L.	<R.L.	<R.L.

R.L. = 5.0 x multiplier
Bold print indicates an exceedance of revised soil cleanup goals
(DUP) - Duplicate sample

Revised Soil Cleanup Goals	
COMPOUND	**GOAL (µg/kg)**
Trichloroethene	230
1,1-Dichloroethene	120
cis-1,2-Dichloroethene	1,500
1,1,1-Trichloroethane	6,140

AHP-4\AHP Table-1.xls

Table 1 (Continued)
North Area - Outside
September 2000 Geoprobe Soil Sampling Results (µg/kg)
EKCO World Kitchen, Massillon, Ohio, Facility

Laboratory ID Number:	14304	14305	14306	14307	14308	14309	14310	14311	14312	14313
Soil Boring Number:	SB-03			SB-04		SB-05			SB-06	
Sample Depth (ft bgs):	3.5	7	9.5	5	10	3	6	10.5	3	6
Multiplier:	10	10	*1*	1	1	1	1	1	1	1
COMPOUND										
Trichloroethene	<R.L.	<R.L.	<R.L.	80	51	<R.L.	<R.L.	<R.L.	209	158
1,1-Dichloroethene	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	9	10	<R.L.
cis-1,2-Dichloroethene	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	19	<R.L.
trans-1,2-Dichloroethene	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.
1,1,1-Trichloroethane	<R.L.	<R.L.	<R.L.	<R.L.	19	<R.L.	<R.L.	<R.L.	113	168

R.L. = 5.0 x multiplier
Bold print indicates an exceedance of revised soil cleanup goals
(DUP) - Duplicate sample

Revised Soil Cleanup Goals	
COMPOUND	**GOAL (µg/kg)**
Trichloroethene	230
1,1-Dichloroethene	120
cis-1,2-Dichloroethene	1,500
1,1,1-Trichloroethane	6,140

Table 2
Southwest Area
September 2000 Geoprobe Soil Sampling Results (µg/kg)
EKCO World Kitchen, Massillon, Ohio, Facility

Laboratory ID Number:	14383	14384	14385	14386	14387	14388	14389	14390	14391	14392
Soil Boring Number:	**SB-07**		**SB-08**		**SB-09**			**SB-10**		
Sample Depth (ft bgs):	**2**	**7.5**	**1.5**	**6.5**	**1.5**	**5.5**	**10**	**2**	**7.5**	**10**
Multiplier:	**1**	**1**	**10**	**32**	**10**	**10**	**313**	**1**	**39**	**1**
COMPOUND										
Trichloroethene	6	<R.L.	**1,350**	**2,650**	**1,630**	**460**	**35,600**	6	<R.L.	<R.L.
1,1-Dichloroethene	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	7	<R.L.	<R.L.
cis-1,2-Dichloroethene	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	**8,560**	<R.L.	<R.L.	<R.L.
trans-1,2-Dichloroethene	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.
1,1,1-Trichloroethane	<R.L.	<R.L.	<R.L.	420	58	<R.L.	<R.L.	<R.L.	**6,950**	7

R.L. = 5.0 x multiplier

Bold print indicates an exceedance of revised soil cleanup goals

(DUP) - Duplicate sample

Revised Soil Cleanup Goals	
COMPOUND	**GOAL (µg/kg)**
Trichloroethene	230
1,1-Dichloroethene	120
cis-1,2-Dichloroethene	1,500
1,1,1-Trichloroethane	6,140

Table 3
North Area - Inside
September 2000 Geoprobe Soil Sampling Results (µg/kg)
EKCO World Kitchen, Massillon, Ohio, Facility

Laboratory ID Number:	14395	14396	14397	14398	14399	14400	14401	14402	14403	14404	14405	14406	14407	14408	14409	14410	14411	14412	14413
Soil Boring Number:	SB-11					SB-12				SB-13				SB-14					
Sample Depth (ft bgs):	2.5	6	10.5	10.5 (DUP)	14	2	6.3	10	14	1.3	1.3 (DUP)	5	9	1	5.5	5.5 (DUP)	10.5	15	19.5
Multiplier:	1	1	35	36	2.5	1	1	37	5	3580	3300	166	850	34	31	9	201	186	180
COMPOUND																			
Trichloroethene	<R.L.	44	**5,720**	**2,050**	**500**	<R.L.	<R.L.	<R.L.	**410**	**273,000**	**36,100**	**9,290**	**137,000**	**7,540**	**1,280**	**570**	<R.L.	<R.L.	**10,000**
1,1-Dichloroethene	<R.L.	37	<R.L.	<R.L.	**210**	**131**	<R.L.	111	49	<R.L.	<R.L.	<R.L.	**6,900**	<R.L.	<R.L.	<R.L.	**1,640**	**1,220**	<R.L.
cis-1,2-Dichloroethene	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	0.05	<R.L.	**2,470**	145	<R.L.	<R.L.	<R.L.	<R.L.	**2,380**	1,290	700	**50,800**	**36,200**	**2,570**
trans-1,2-Dichloroethene	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	**1,770**	<R.L.	<R.L.
1,1,1-Trichloroethane	<R.L.	82	<R.L.	400	277	25	<R.L.	2,400	1,020	**544,000**	**71,800**	**24,200**	**140,000**	930	430	210	1,820	**17,900**	**17,800**

R.L. = 5.0 x multiplier
Bold print indicates an exceedance of revised soil cleanup goals
(DUP) - Duplicate sample

Revised Soil Cleanup Goals

COMPOUND	GOAL (µg/kg)
Trichloroethene	230
1,1-Dichloroethene	120
cis-1,2-Dichloroethene	1,500
1,1,1-Trichloroethane	6,140

Table 4
West Area
September 2000 Geoprobe Soil Sampling Results (µg/kg)
EKCO World Kitchen, Massillon, Ohio, Facility

Laboratory ID Number:	14453	14454	14455	14456	14457	14458	14459	14560	14461	14462	14463
Soil Boring Number:	SB-15		SB-16		SB-17		SB-18		SB-19		
Sample Depth (ft bgs):	2.6	6.5	2	7.5	2	6	2.5	7	3	3 (DUP)	6
Multiplier:	1	1	1	30	78	157	2.5	1	1	1	1
COMPOUND											
Trichloroethene	130	<R.L.	6	**6,930**	**5,580**	**20,900**	**540**	27	<R.L.	<R.L.	<R.L.
1,1-Dichloroethene	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.
cis-1,2-Dichloroethene	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.
trans-1,2-Dichloroethene	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.
1,1,1-Trichloroethane	6	<R.L.	6	960	<R.L.	880	74	43	<R.L.	<R.L.	<R.L.

R.L. = 5.0 x multiplier
Bold print indicates an exceedance of revised soil cleanup goals
(DUP) - Duplicate sample

Revised Soil Cleanup Goals

COMPOUND	GOAL (µg/kg)
Trichloroethene	230
1,1-Dichloroethene	120
cis-1,2-Dichloroethene	1,500
1,1,1-Trichloroethane	6,140

AHP-4\AHP Table-4.xls

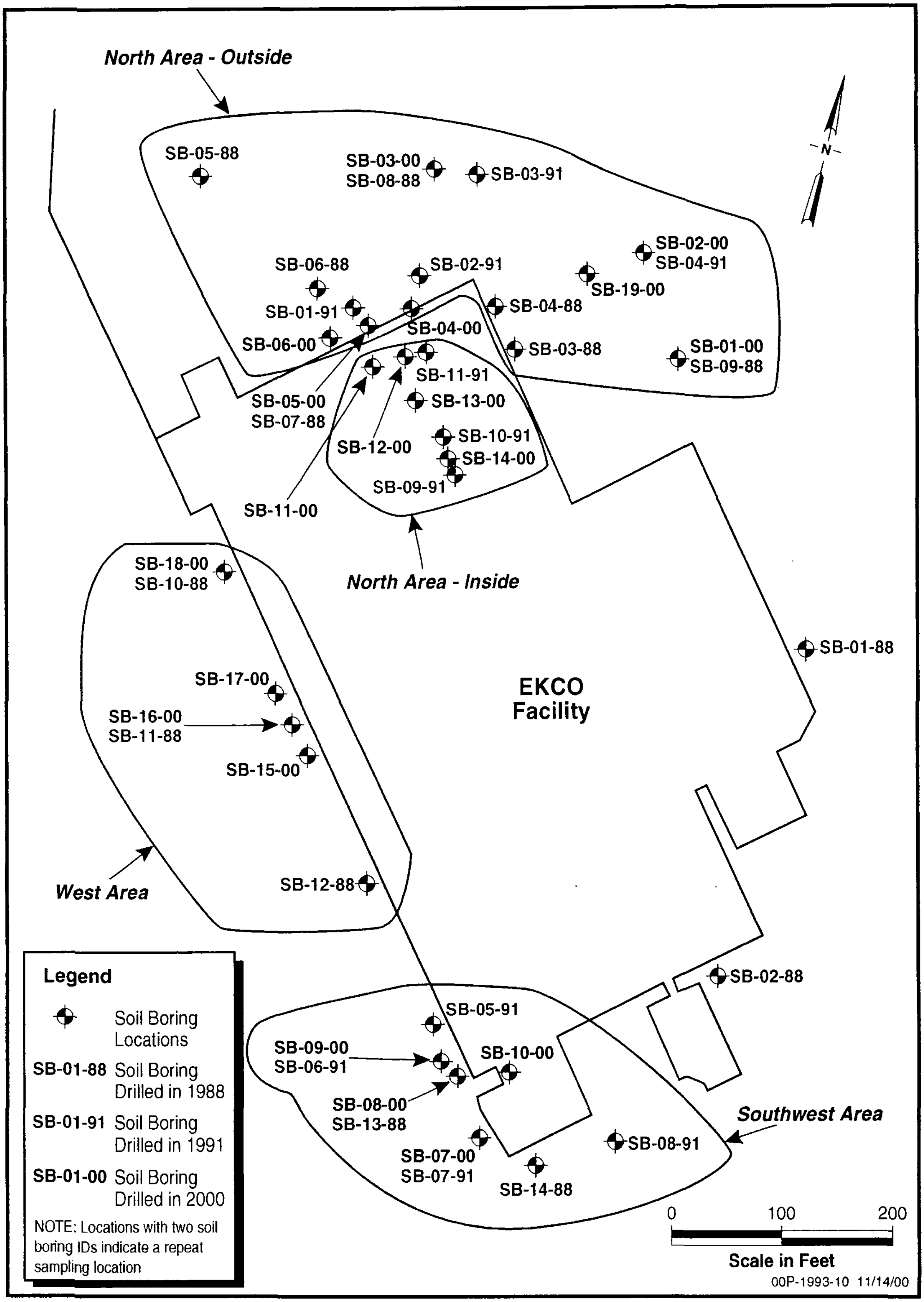


FIGURE 1 AREAS OF INVESTIGATION AND 1988, 1991, AND 2000 SOIL BORING LOCATIONS

WESTON
MANAGERS DESIGNERS/CONSULTANTS

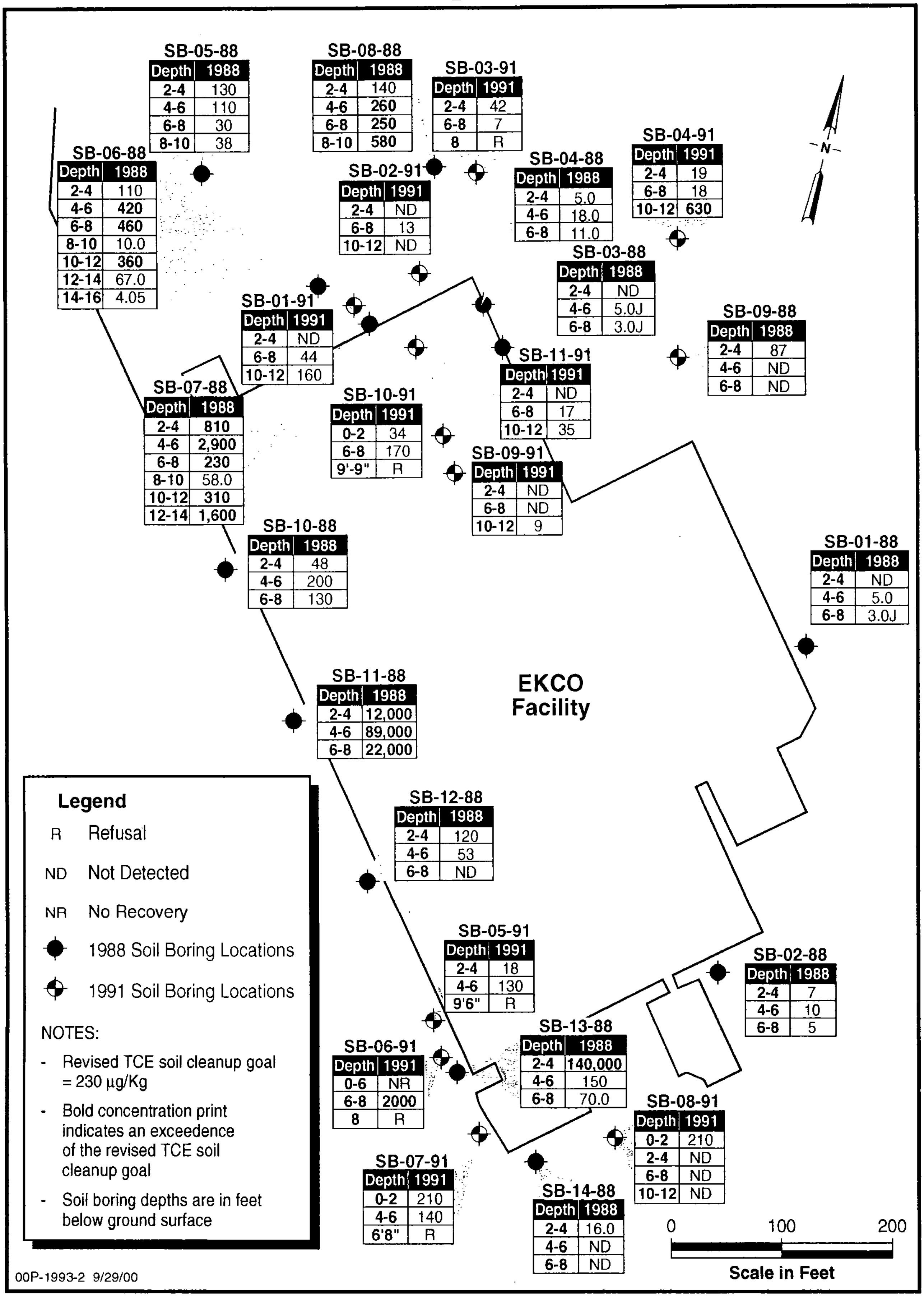


FIGURE 2 1988 AND 1991 TRICHLOROETHENE (TCE) CONCENTRATIONS (µg/kg) IN SOIL BORING SAMPLES

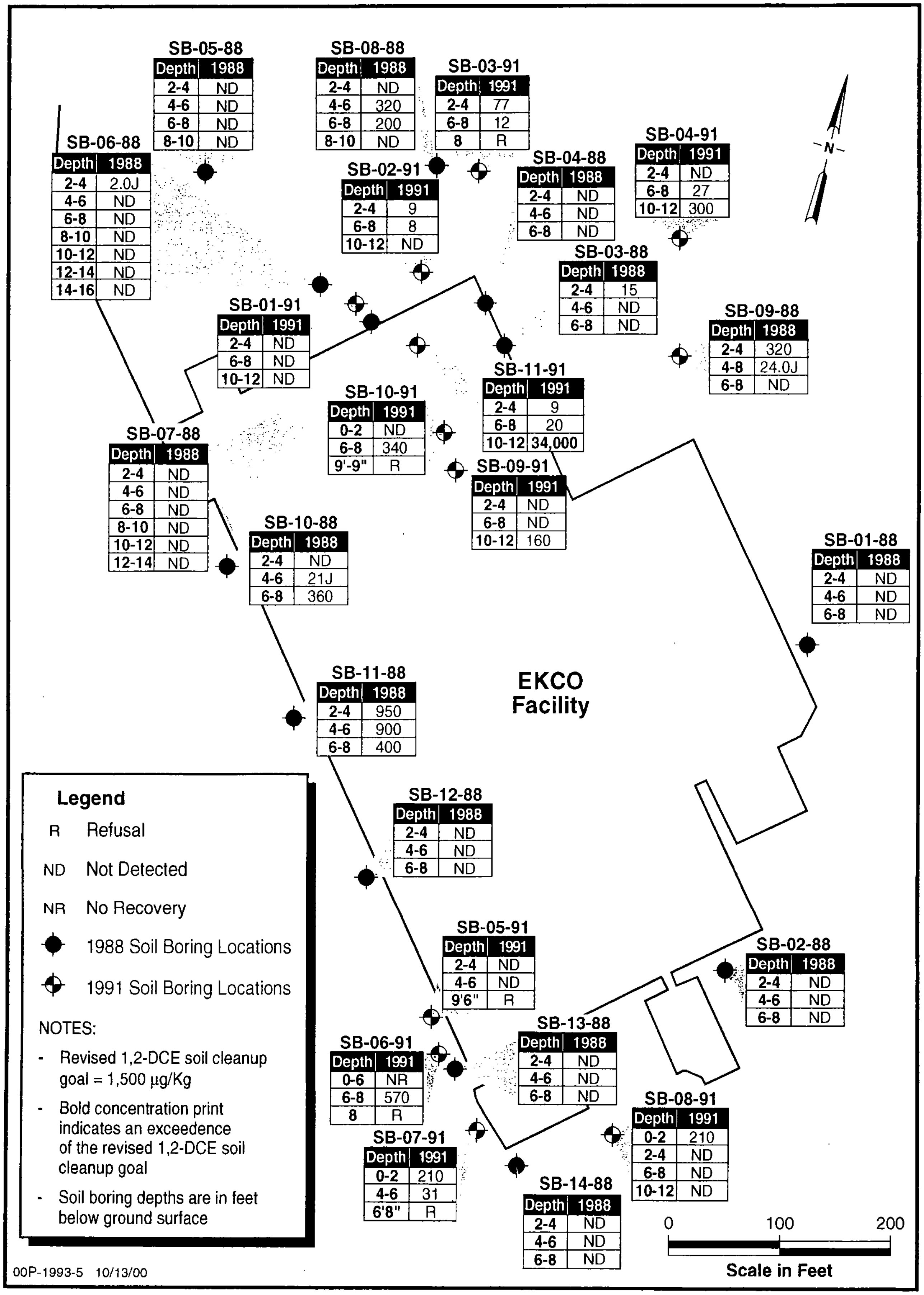


FIGURE 3 1988 AND 1991 CIS - 1,2 DICHLOROETHENE (1,2-DCE) CONCENTRATIONS (µg/kg) IN SOIL BORING SAMPLES

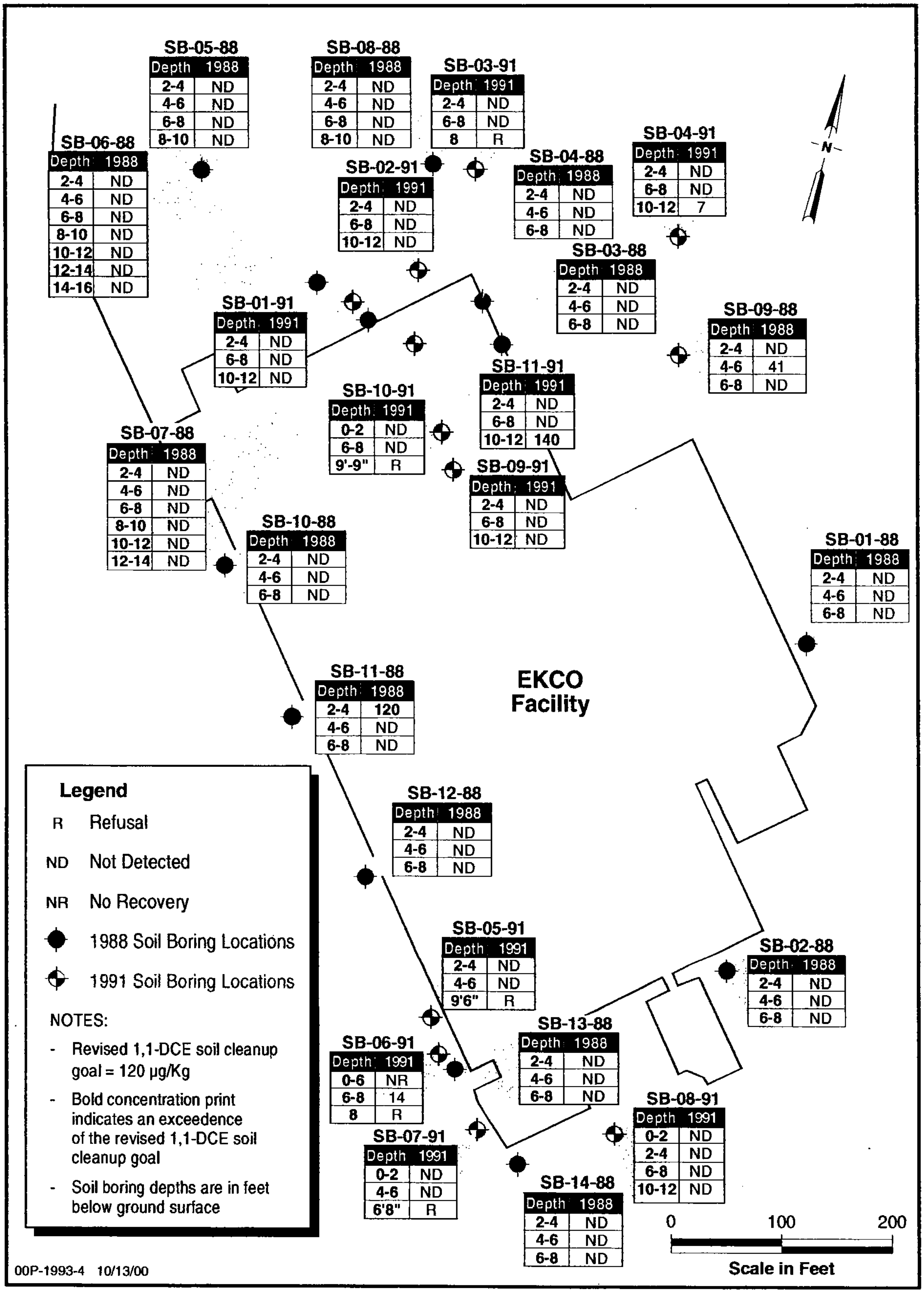


FIGURE 4 1988 AND 1991 1,1 DICHLOROETHENE (1,1-DCE) CONCENTRATIONS (µg/kg) IN SOIL BORING SAMPLES

WESTON
MANAGERS DESIGNERS/CONSULTANTS

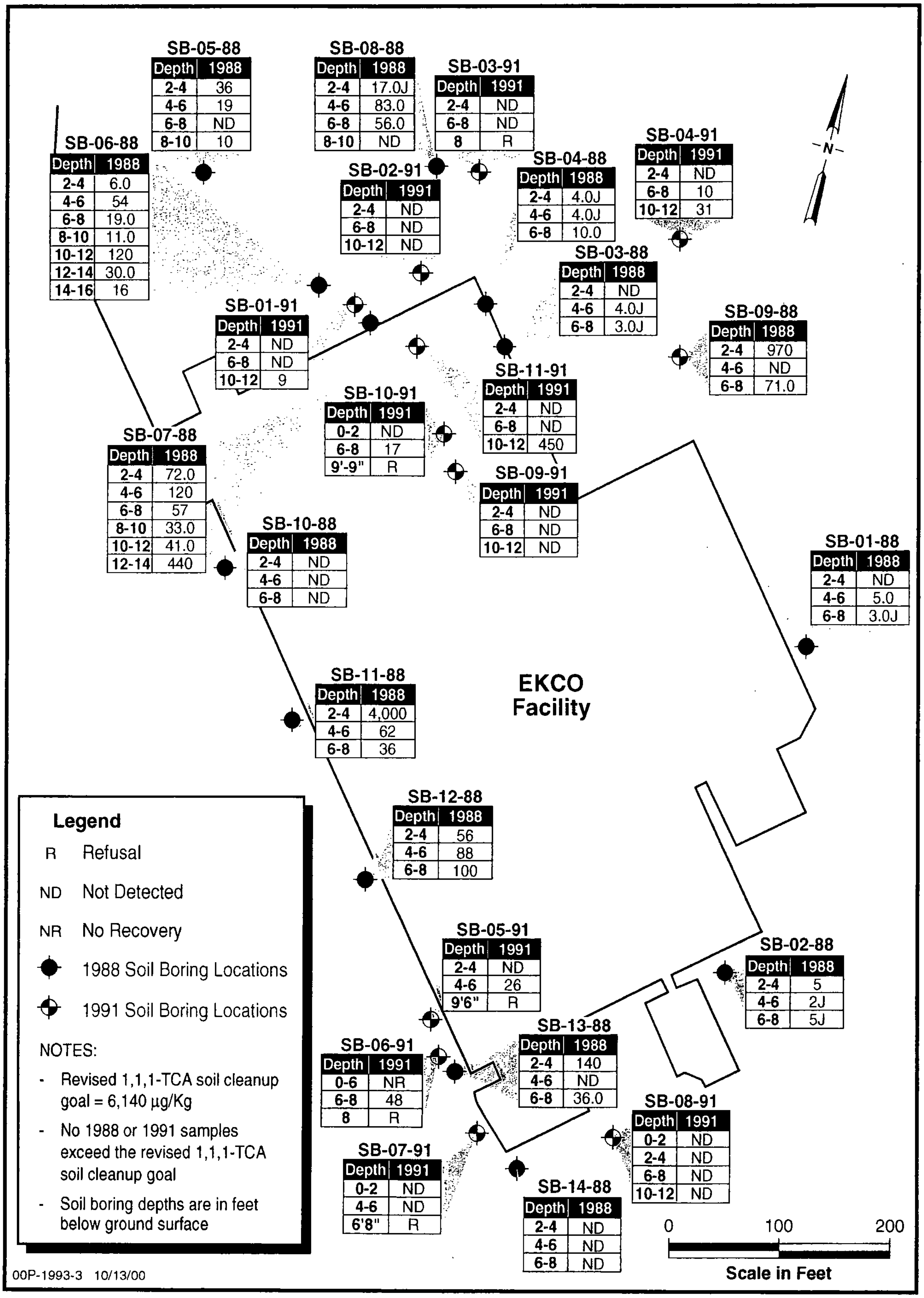


FIGURE 5 1988 AND 1991 1,1,1 TRICHLOROETHANE (1,1,1-TCA) CONCENTRATIONS (µg/kg) IN SOIL BORING SAMPLES

WESTON
MANAGERS DESIGNERS/CONSULTANTS

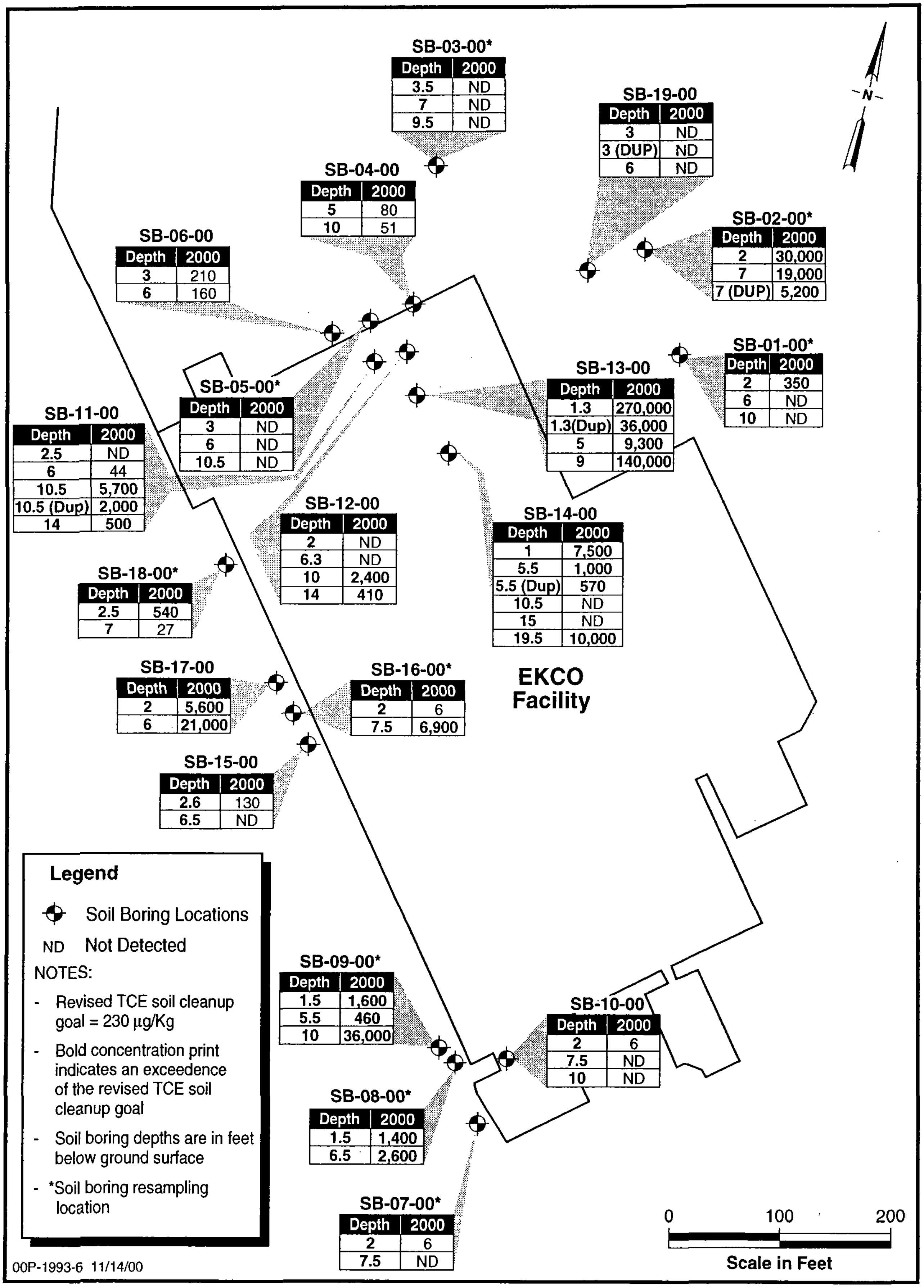


FIGURE 6 SEPTEMBER 2000 TRICHLOROETHENE (TCE) CONCENTRATIONS (µg/kg) IN SOIL BORING SAMPLES

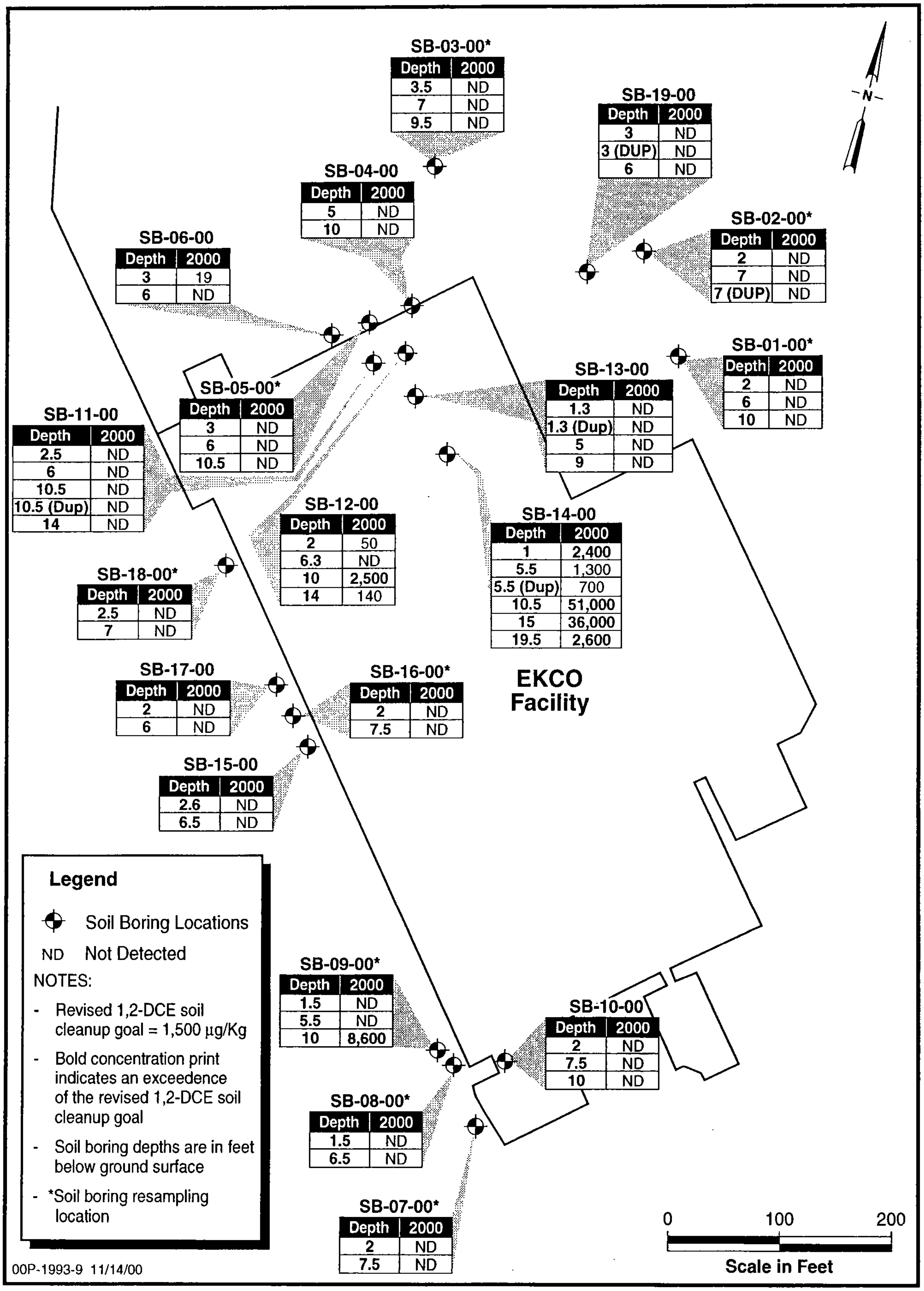
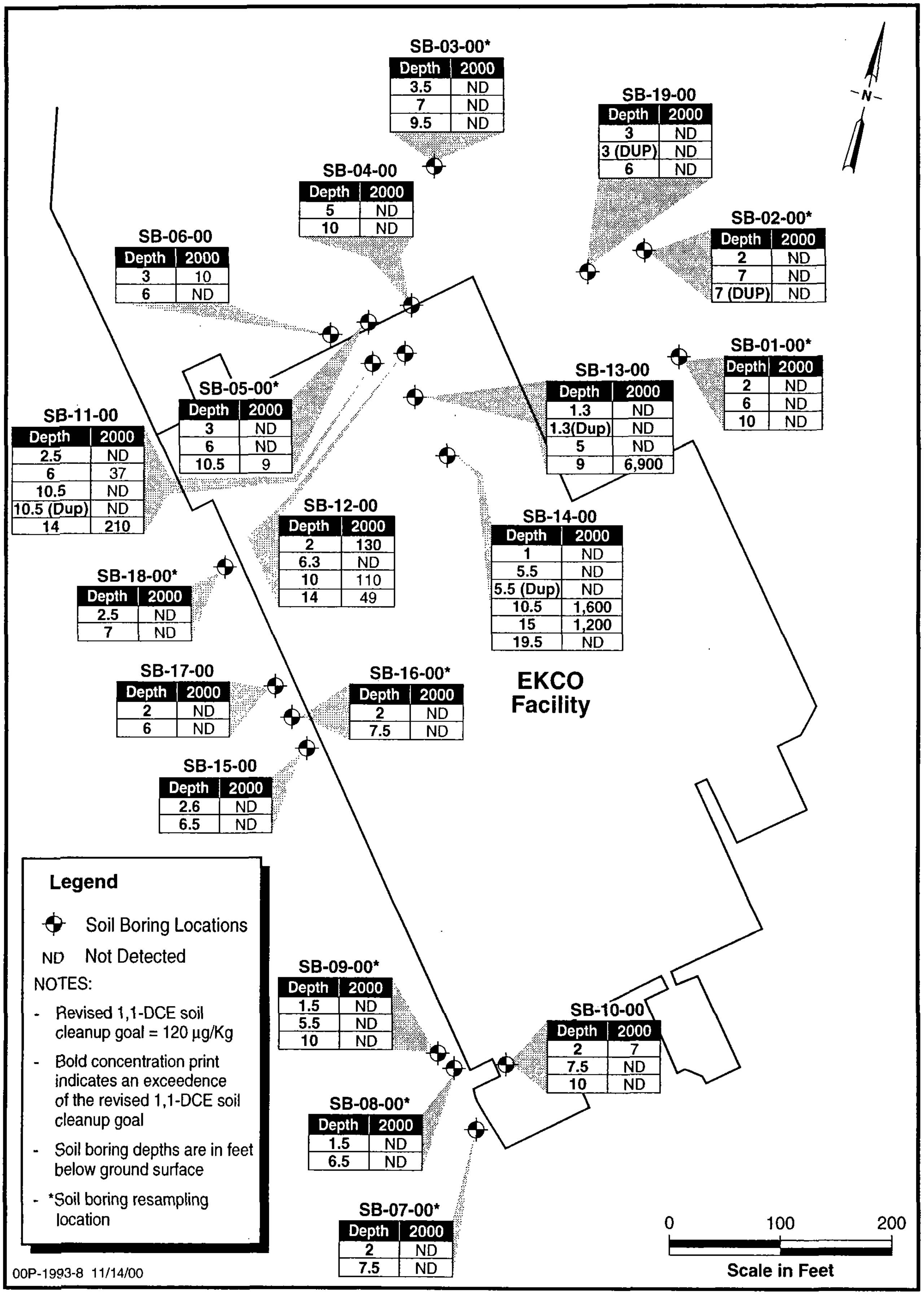


FIGURE 7 SEPTEMBER 2000 CIS - 1,2 DICHLOROETHENE (1,2-DCE) CONCENTRATIONS (μg/kg) IN SOIL BORING SAMPLES

WESTON
MANAGERS DESIGNERS/CONSULTANTS



SB-03-00*

Depth	2000
3.5	ND
7	ND
9.5	ND

SB-19-00

Depth	2000
3	ND
3 (DUP)	ND
6	ND

SB-04-00

Depth	2000
5	ND
10	ND

SB-02-00*

Depth	2000
2	ND
7	ND
7 (DUP)	ND

SB-06-00

Depth	2000
3	10
6	ND

SB-01-00*

Depth	2000
2	ND
6	ND
10	ND

SB-13-00

Depth	2000
1.3	ND
1.3(Dup)	ND
5	ND
9	6,900

SB-05-00*

Depth	2000
3	ND
6	ND
10.5	9

SB-11-00

Depth	2000
2.5	ND
6	37
10.5	ND
10.5 (Dup)	ND
14	210

SB-12-00

Depth	2000
2	130
6.3	ND
10	110
14	49

SB-14-00

Depth	2000
1	ND
5.5	ND
5.5 (Dup)	ND
10.5	1,600
15	1,200
19.5	ND

SB-18-00*

Depth	2000
2.5	ND
7	ND

SB-17-00

Depth	2000
2	ND
6	ND

SB-16-00*

Depth	2000
2	ND
7.5	ND

SB-15-00

Depth	2000
2.6	ND
6.5	ND

SB-09-00*

Depth	2000
1.5	ND
5.5	ND
10	ND

SB-10-00

Depth	2000
2	7
7.5	ND
10	ND

SB-08-00*

Depth	2000
1.5	ND
6.5	ND

SB-07-00*

Depth	2000
2	ND
7.5	ND

FIGURE 8 SEPTEMBER 2000 1,1 DICHLOROETHENE (1,1-DCE) CONCENTRATIONS (µg/kg) IN SOIL BORING SAMPLES

WESTON
MANAGERS DESIGNERS/CONSULTANTS

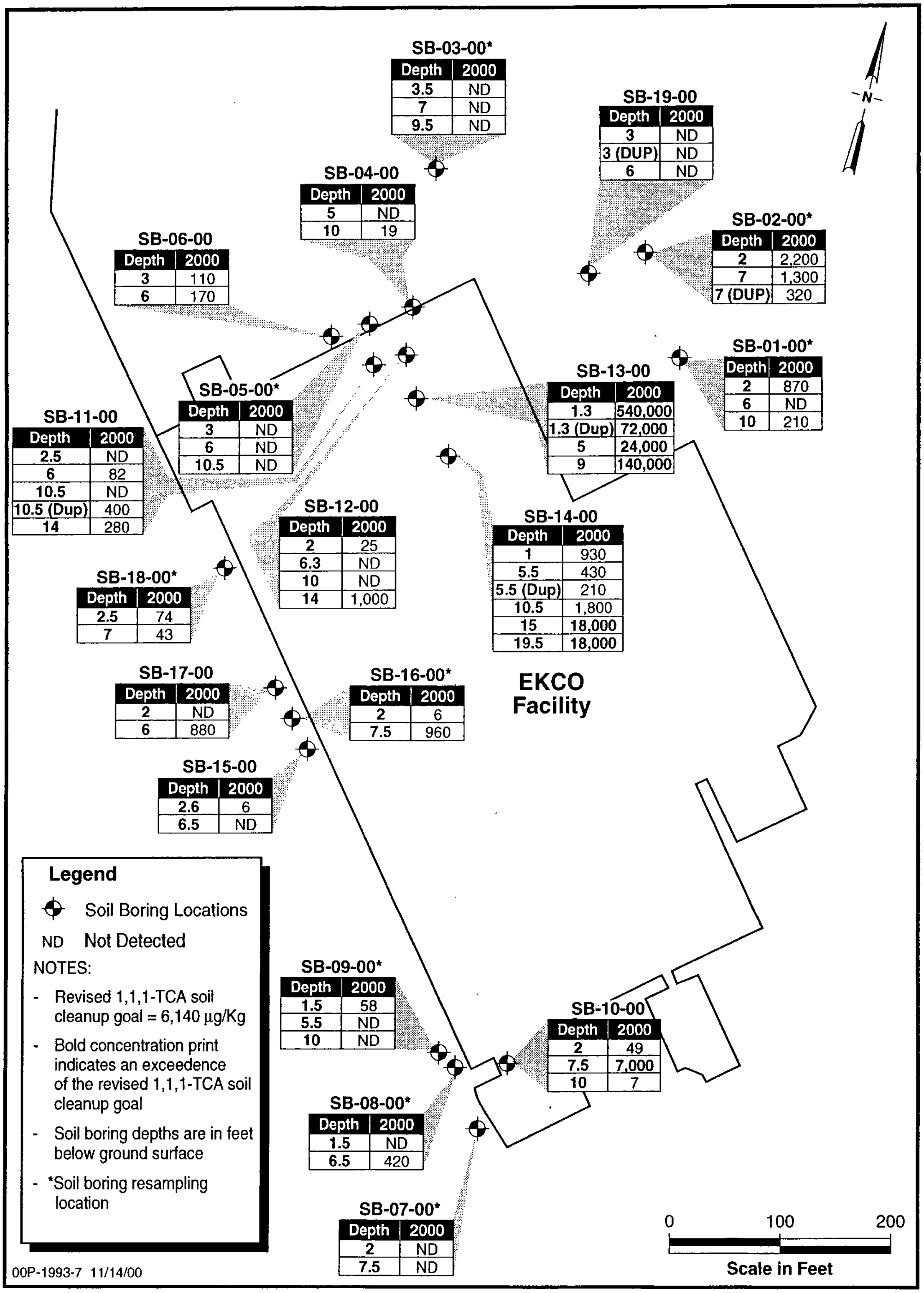


FIGURE 9 SEPTEMBER 2000 1,1,1 TRICHLOROETHANE (1,1,1-TCA) CONCENTRATIONS (µg/kg) IN SOIL BORING SAMPLES

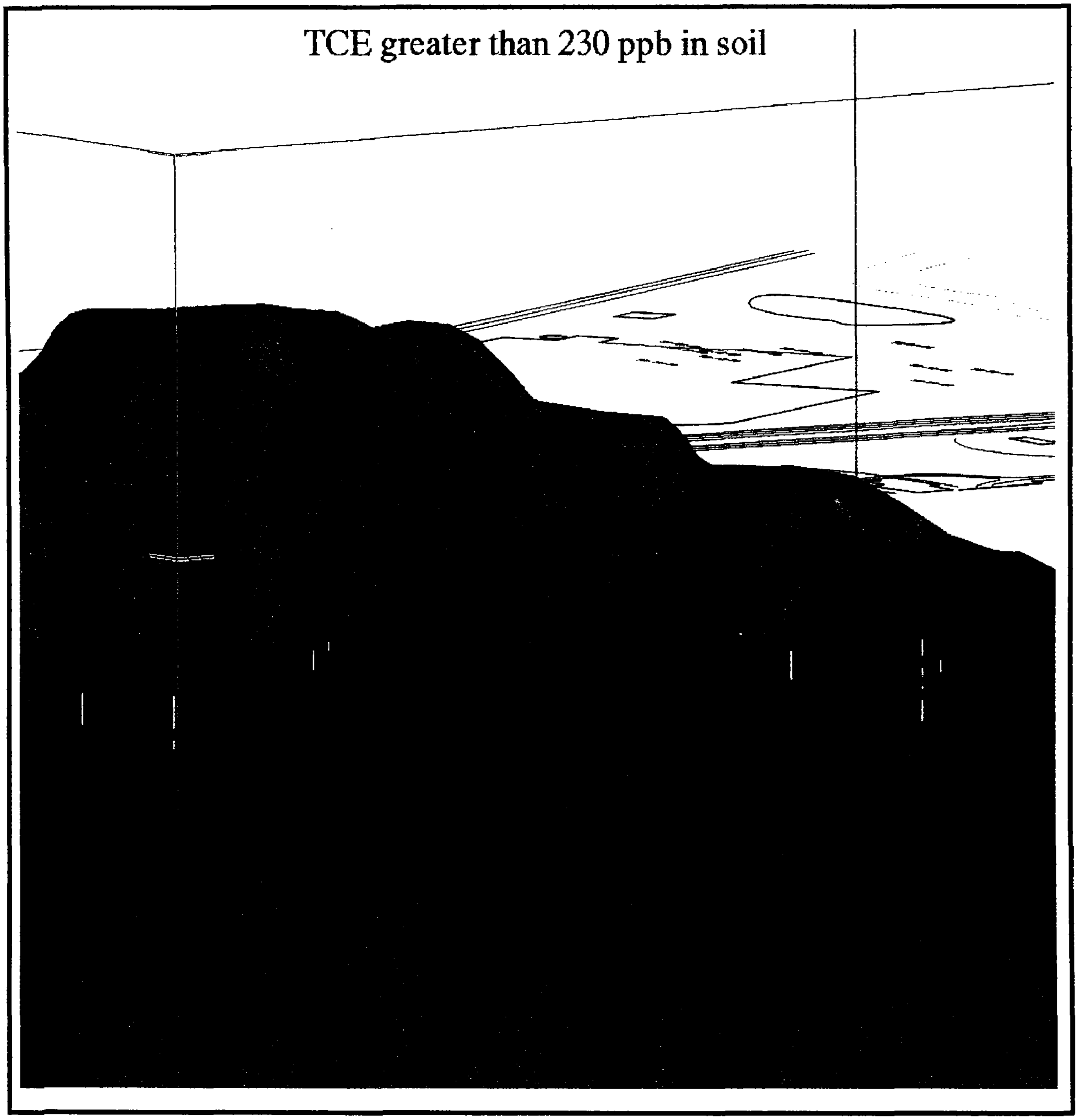


FIGURE 10 **EXTENT OF SEPTEMBER 2000 SOIL TCE CONCENTRATIONS EXCEEDING 230 µg/Kg**

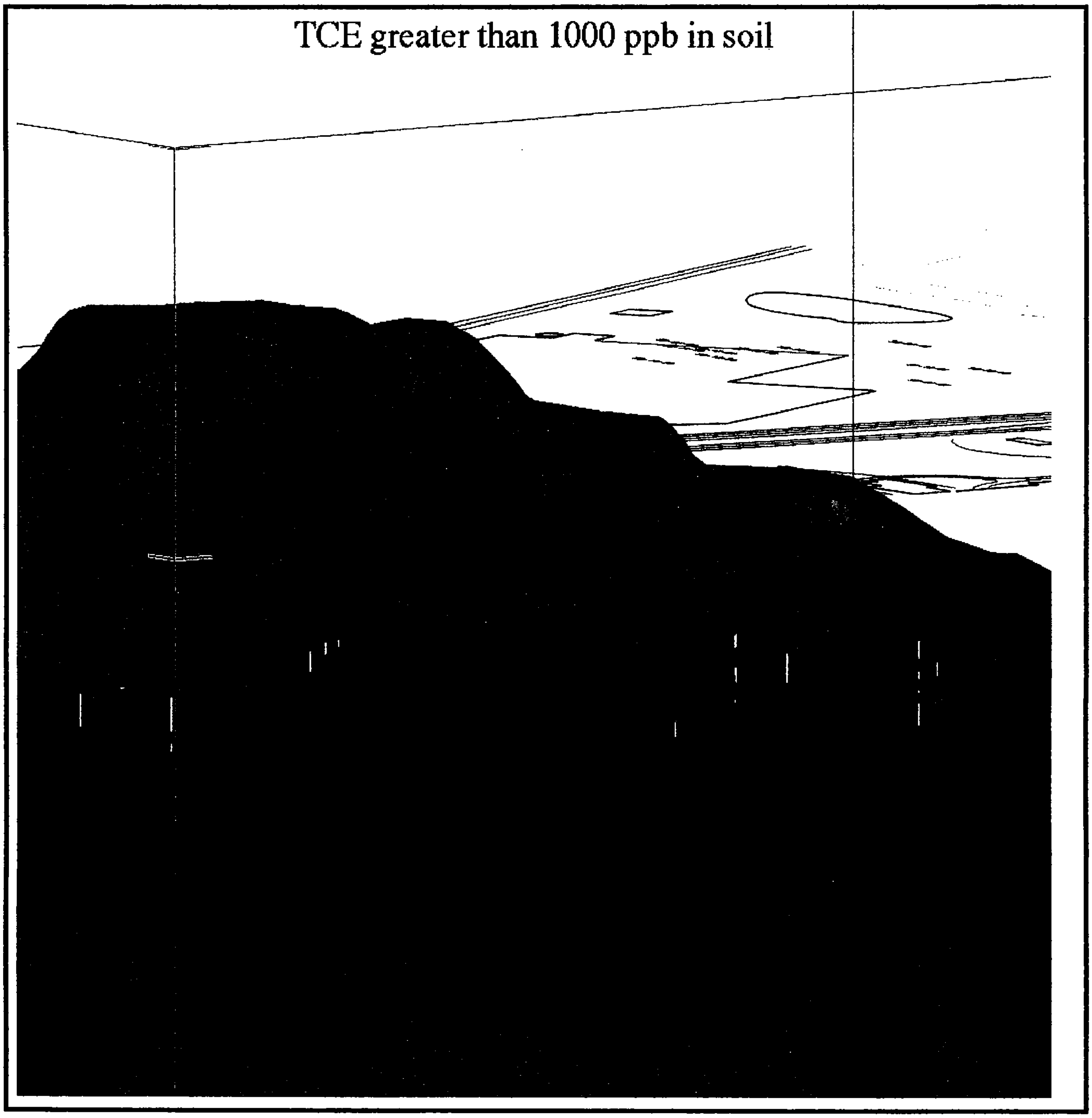


FIGURE 11 **EXTENT OF SEPTEMBER 2000 SOIL TCE CONCENTRATIONS EXCEEDING 1,000 μg/Kg**

APPENDIX 1
FEBRUARY 1999 GROUNDWATER ELEVATION CONTOUR MAPS

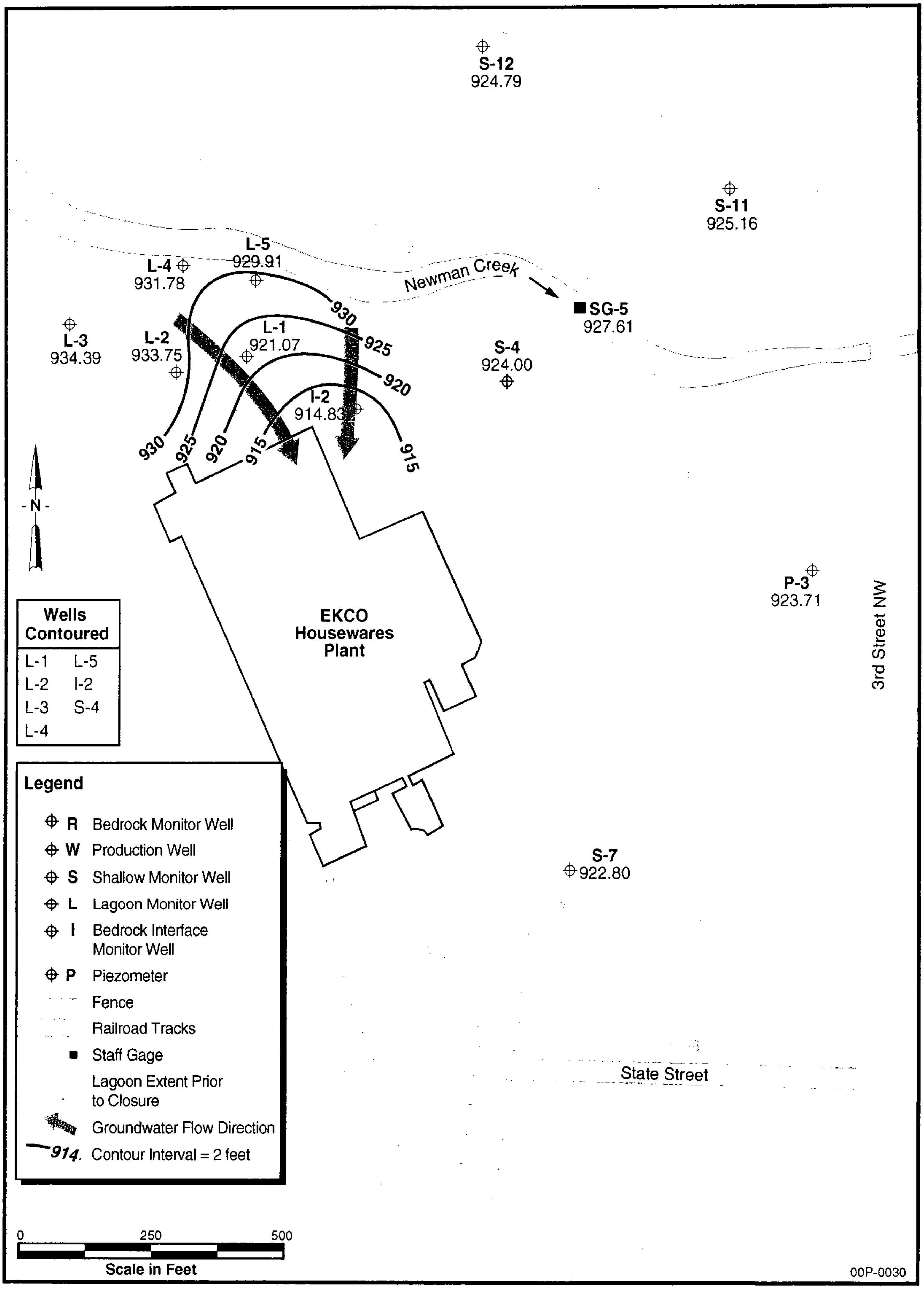


FIGURE 4-1 GROUNDWATER CONTOUR MAP OF WELLS COMPLETED IN THE SHALLOW WATER-BEARING ZONE WATER LEVELS MEASURED 15 FEBRUARY 1999

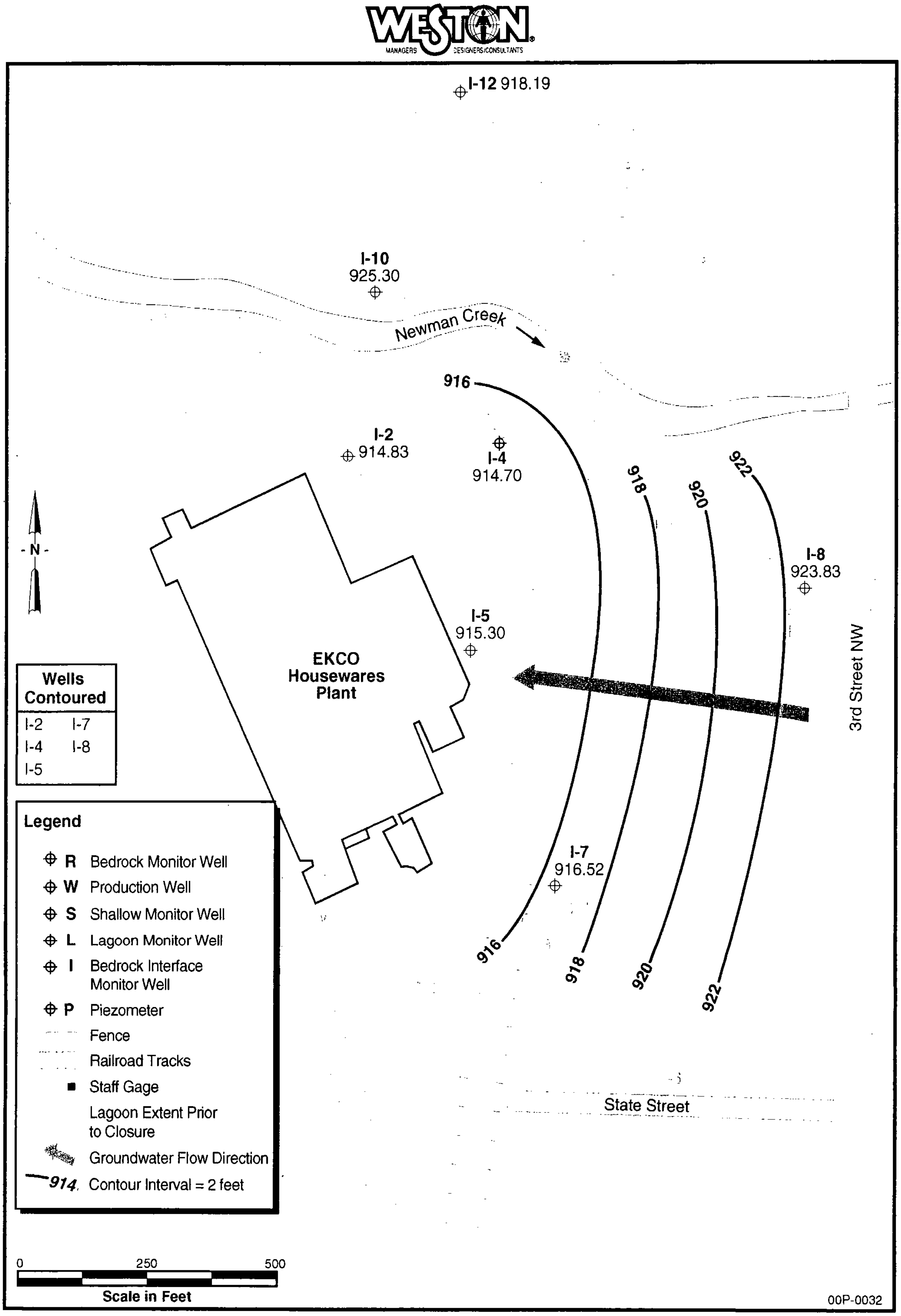


FIGURE 4-3 GROUNDWATER CONTOUR MAP OF WELLS COMPLETED IN THE INTERMEDIATE WATER-BEARING ZONE WATER LEVELS MEASURED 15 FEBRUARY 1999

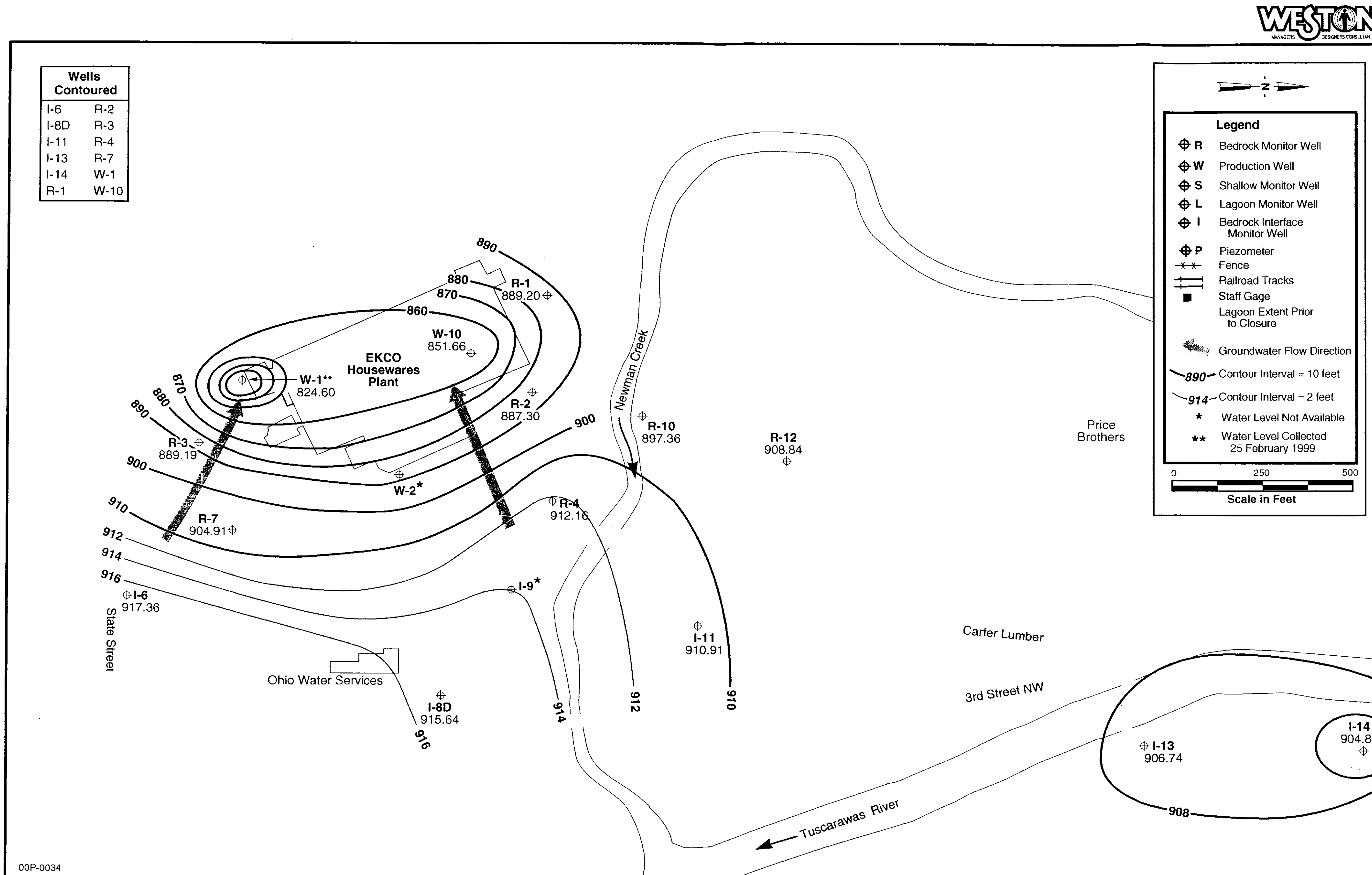


FIGURE 4-5 GROUNDWATER CONTOUR MAP OF WELLS COMPLETED IN THE DEEP UNCONSOLIDATED AND BEDROCK WATER-BEARING ZONES WATER LEVELS MEASURED 15 FEBRUARY 1999

APPENDIX 2
MAP SHOWING AREAS RECOMMENDED FOR SOIL REMEDIATION IN RFI/CMS

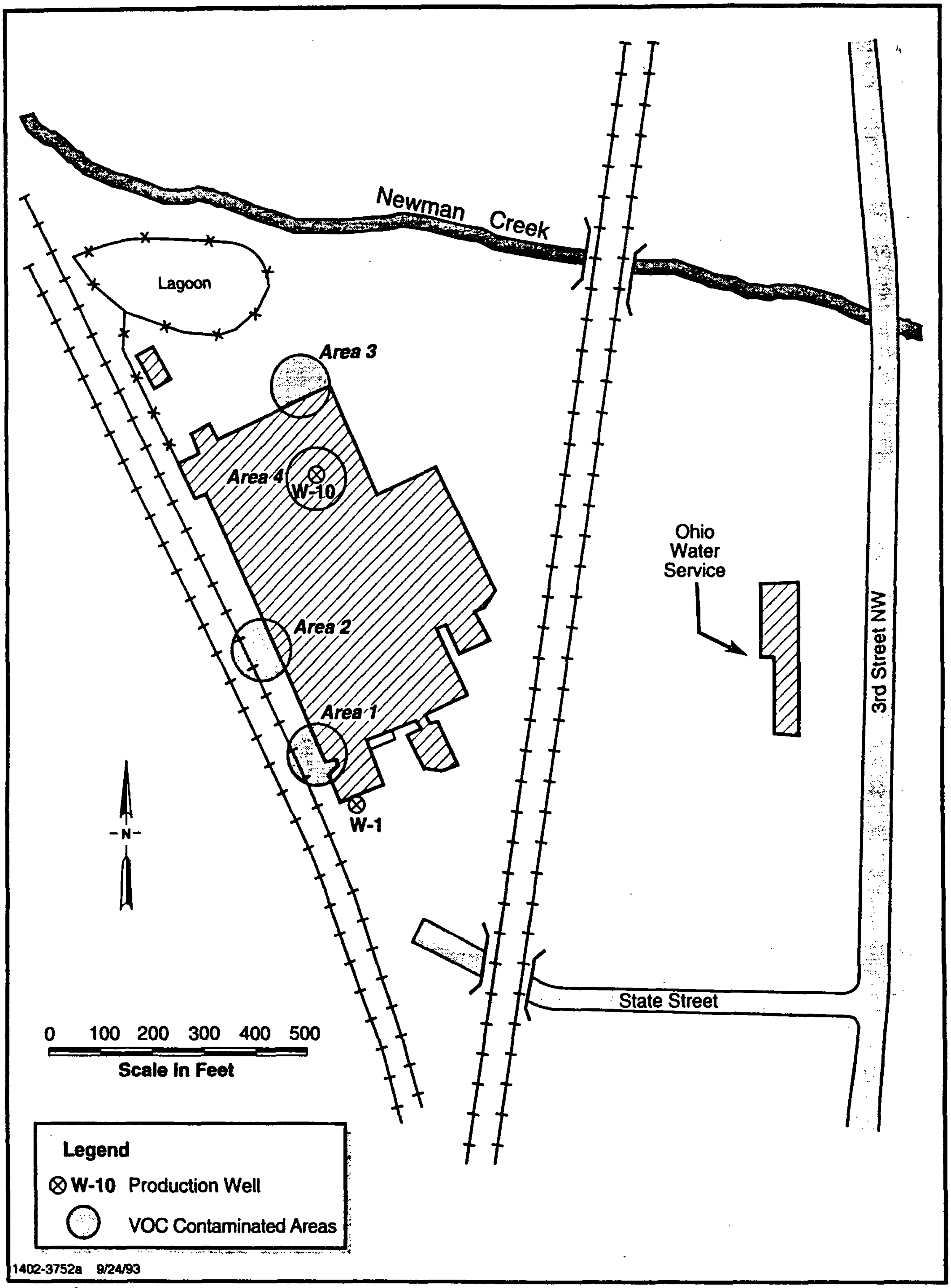


FIGURE 5-3 VOC-CONTAMINATED AREAS EXCEEDING SOIL CLEANUP GOALS

APPENDIX 3
SOIL BORING LOGS

WESTON	SOIL BORING LOG		PAGE 1 OF 1
Job Name	**Ekco World Kitchen Housewares**	**Boring No.**	**SB-01-00**
Date Drilled	20 September 2000	**Boring Method**	Geoprobe Rig
Drilling Co.	Frontz Drilling	**Completion Depth**	12.0 ft bgs
Drill Foreman	Jamie Foth	**Location**	Ekco Facility, Massillon, Ohio
Logged By	Dave Cairns, Greg Flasinski		

Depth (feet)	Sample No.	OVM Reading	Laboratory Sample ID	Moisture		Visual Description	% Rec
	s1	Bkg		Dry	0-0.42'	gray-brown SILT (topsoil), trace gravel and fine sand, loose	65
	s1	Bkg	SB-01-2.0-00		0.42-4.3'	FILL, some silt, sand, pebbles, poorly sorted, loose; some areas of black soil but did not record any elevated OVM readings (asphalt?)	
	s1	Bkg					
4	s1	Bkg					
					4.3-5.0'	lt gray-brown clayey SILT, some pebbles, loose	96
	s2	Bkg		Dry	5.0-5.5'	lt. Brown SAND (f-cs), some pebbles and small gravel, trace silt	
	s2	Bkg	SB-01-6.0-00		5.5-7.0'	gray to black SAND, poorly sorted-still in fill, slight odor at 6 ft bgs - no readings on OVM though.	
	s2	Bkg		Moist	7.0-8.3'	lt brown to gray-brown clayey SILT, slightly plastic	
8	s2	Bkg					
	s3	Bkg			8.3-10.7'	dark gray-brown to black to brown gravelly SAND to SAND (still in Fill material).	96
	s3	Bkg	SB-01-10.0-00	Moist	10.7-11.9'	brown sandy SILT, trace gravel and clay, loose (natural material)	
	s3	Bkg					
12	s3	Bkg					
						Total depth of Geoprobe - 12.0 ft bgs.	

Note: **SB-01-00 was drilled in the vicinity of the former SB-09 (1988)**

Geoprobe samples are collected continuously in 4-foot sections using disposable liner.

WESTON		SOIL BORING LOG	PAGE 1 OF 1
Job Name	**Ekco World Kitchen Housewares**	**Boring No.**	**SB-02-00**
Date Drilled	20 September 2000	**Boring Method**	Geoprobe Rig
Drilling Co.	Frontz Drilling	**Completion Depth**	12.0 ft bgs
Drill Foreman	Jamie Foth	**Location**	Ekco Facility, Massillon, Ohio
Logged By	Dave Cairns, Greg Flasinski		

Depth (feet)	Sample No.	OVM Reading	Laboratory Sample ID	Moisture		Visual Description	% Rec
_	s1	Bkg		Dry	0-2'	lt. Brown to daark brown SAND , fine to med grained, and SILT, some gravel in top 4", trace clay, loose.	65
_	s1		SB-02-2.0-00				
_	s1				2-4.3'	Reddish-brown to brown SAND, color change to brick color, some pebbles and small gravel, very loose.	
4__	s1	60 ppm					
					4.0-4.3'	Same as above.	96
_	s2			Dry	4.3-6.25'	Fine to coarse, poorly sorted FILL, some asphalt, loose.	
_	s2						
_	s2		SB-02-7.0-00 (DUP)	Moist-wet	6.25-7.8'	Dark brown gravelly SAND, moist to wet at bottom of interval, elevated OVM readings.	
8__	s2	7 ppm					
				Wet	8.0-8.8'	reddish-brown to gray GRAVEL, fine.	50
_	s3				8.8-10'	Brown-gray CLAY, some gravel and pebbles, lower percentage of gravel towards bottom of interval, clay is soft, plastic, moist.	
_	s3		No Sample		--	No sample collected from this interval due to saturated conditions.	
_	s3						
12__	s3						
						Total depth of Geoprobe - 12.0 ft bgs.	
_							
_							
_							

Note: **SB-02-00 was drilled in the vicinity of the former SB-04 (1991)**

Geoprobe samples are collected continuously in 4-foot sections using disposable liner.

Job Name	**Ekco World Kitchen Housewares**	**Boring No.**	**SB-03-00**
Date Drilled	20 September 2000	**Boring Method**	Geoprobe Rig
Drilling Co.	Frontz Drilling	**Completion Depth**	12.0 ft bgs
Drill Foreman	Jamie Foth	**Location**	Ekco Facility, Massillon, Ohio
Logged By	Dave Cairns, Greg Flasinski		

Depth (feet)	Sample No.	OVM Reading	Laboratory Sample ID	Moisture		Visual Description	% Rec
	s1	Bkg			0-1.25'	Gray to dark gray-brown sandy GRAVEL, (FILL), some asphalt, trace silt.	88
	s1	1-7 ppm	SB-03-3.5-00	Sl moist	1.25-3.5'	Gray gravelly SAND to sandy GRAVEL, (FILL), loose. Brick in very bottom of spoon.	
	s1	max - 100 ppm					
4	s1						
		Bkg		Moist	4.0-6.0'	gray SAND, fine to medium grained, FILL, some glass shards, brick.	88
	s2	49 ppm					
		37 ppm					
	s2	92 ppm					
		90 ppm			6.0-7.5'	Gray to dark gray-brown SAND, some gravel, loose.	
	s2	115 ppm	SB-03-7.0-00			piece of cloth 7'.	
		65 ppm					
8	s2						
		69 ppm		Moist	8.0-9.05'	Gray to brown sandy GRAVEL, loose	50
	s3	Bkg		Wet	9.05-10.0'	Dark gray CLAY, trace silt and fine sand, trace	
		Bkg	SB-03-9.5-00			pebbles, soft, odor but no readings on OVM.	
	s3	Bkg				Wet just above Clay.	
	s3						
12	s3						
						Total depth of Geoprobe - 12.0 ft bgs.	

Note: **SB-03-00 was drilled in the vicinity of the former SB-08 (1988)**

Geoprobe samples are collected continuously in 4-foot sections using disposable liner.

WESTON	SOIL BORING LOG	PAGE 1 OF 1	
Job Name	**Ekco World Kitchen Housewares**	**Boring No.**	**SB-04-00**
Date Drilled	20 September 2000	**Boring Method**	Geoprobe Rig
Drilling Co.	Frontz Drilling	**Completion Depth**	12.0 ft bgs
Drill Foreman	Jamie Foth	**Location**	Ekco Facility, Massillon, Ohio
Logged By	Dave Cairns, Greg Flasinski		

Depth (feet)	Sample No.	OVM Reading	Laboratory Sample ID	Moisture		Visual Description	% Rec
		Bkg.			0-1.5'	Lt. Gray to brown sandy GRAVEL grades to a	
_	s1	Bkg.				gravelly SAND toward bottom of interval	83
		Bkg.		Sl. Moist	1.5-5.5'	Lt. Brown to brown SAND, very fine to fine, little	
_	s1	Bkg.				silt and gravel, FILL	
		Bkg.					
_	s1	Bkg.					
		Bkg.					
4__	s1	Bkg.					
		Bkg.					55
_	s2	Bkg.	SB-04-5.0-00	Moist	5.5-6.2'	Brown sandy SILT, some pebbles/ small gravel,	
		Bkg.	(MS/MSD)			some clay, plastic.	
_	s2	Bkg.					
		Bkg.					
_	s2	Bkg.					
		Bkg.					
8__	s2						
		Bkg.		Moist	8.0-9.0'	Orange brown GRAVEL, some sand, fine to medium	50
_	s3	Bkg.				grained, trace silt and clay, FILL, loose.	
		Bkg.			9.0-9.5'	Lt. Gray SANDSTONE, able to push spoon through	
_	s3	Bkg.	SB-04-10-00			this interval, may have been a cobble.	
				Wet	9.5-10.0'	Brown clayey SILT, some sand, moist to wet in	
_	s3					bottom of interval, trace gravel, highly plastic.	
12__	s3						
						Total depth of Geoprobe - 12.0 ft bgs.	
_							
_							
_							

Note: **Geoprobe samples are collected continuously in 4-foot sections using disposable liner.**

WESTON		SOIL BORING LOG	PAGE 1 OF 1
Job Name	Ekco World Kitchen Housewares	**Boring No.**	SB-05-00
Date Drilled	20 September 2000	**Boring Method**	Geoprobe Rig
Drilling Co.	Frontz Drilling	**Completion Depth**	12.0 ft bgs
Drill Foreman	Jamie Foth	**Location**	Ekco Facility, Massillon, Ohio
Logged By	Dave Cairns, Greg Flasinski		

Depth (feet)	Sample No.	OVM Reading	Laboratory Sample ID	Moisture		Visual Description	% Rec
		Bkg.			0-0.75'	Dark gray to black sandy GRAVEL, trace silt, clay,	
	s1	Bkg.				FILL, loose	88
		Bkg.		Sl. Moist	0.75-3.5'	Gray-brown SAND and GRAVEL, poorly sorted,	
	s1	Bkg.				FILL, loose	
		Bkg.					
	s1	Bkg.	SB-05-3.0-00				
		Bkg.					
4	s1	Bkg.					
		Bkg.		Moist	4.0-5.5'	Gray-brown CLAY, some rounded gravel, plastic.	96
	s2	Bkg.					
		Bkg.			5.5-6.0'	Lt. Gray SAND, fine to medium grained, loose, some	
	s2	Bkg.	SB-05-6.0-00			sandstone peble fragments.	
		Bkg.		Moist	6.0-7.0'	Orange-brown sandy SILT, some pebbles, gravel and	
	s2	Bkg.				clay, poorly sorted, slightly plastic.	
		Bkg.		Moist	7.0-7.8'	Brown to black clayey SILT, some sand, little gravel	
8	s2	Bkg.				and pebbles, plastic. Higher percentage of clay than	
		Bkg.				previous sample.	75
	s3	Bkg.			8.0-8.7'	Same as above. Grades to more granular at bottom.	
		Bkg.		Moist	8.7-9.0'	Gray-brown sandy GRAVEL, loose.	
	s3	Bkg.		Moist	9.0-9.6'	Brown CLAY, little silt, soft, highly plastic, piece	
		Bkg.	SB-05-10.5-00			of gravel at bottom of interval	
	s3	Bkg.		Moist	9.8-13.0'	Gray to black CLAY, trace silt, sand and pebbles /	
		Bkg.				small gravel, plastic.	
12	s3	Bkg.				Intermittent lenses of lt. Brown sandy CLAY (3 lenses	
		Bkg.				0.5" thick within a 1' interval)	100
	s4	Bkg.			13.0'	Probe refusal.	
						Total depth of Geoprobe - 13.0 ft bgs.	

Note: **SB-05-00 was drilled in the vicinity of the former SB-07 (1988)**

Geoprobe samples are collected continuously in 4-foot sections using disposable liner.

WESTON	SOIL BORING LOG		PAGE 1 OF 1
Job Name	**Ekco World Kitchen Housewares**	**Boring No.**	**SB-06-00**
Date Drilled	20 September 2000	**Boring Method**	Geoprobe Rig
Drilling Co.	Frontz Drilling	**Completion Depth**	12.0 ft bgs
Drill Foreman	Jamie Foth	**Location**	Ekco Facility, Massillon, Ohio
Logged By	Dave Cairns, Greg Flasinski		

Depth (feet)	Sample No.	OVM Reading	Laboratory Sample ID	Moisture		Visual Description	% Rec
		Bkg.			0-0.25'	GRAVEL layer, FILL	
_	s1	Bkg.		Moist	0.25-2.8'	Gray-brown SILT and SAND, some clay,	90
		Bkg.				gravel, slightly plastic, FILL	
_	s1	Bkg.					
		Bkg.					
_	s1	Bkg.	SB-06-3.0-00		2.8-3.0'	Brown weathered SANDSTONE (FILL)	
		Bkg.		Moist	3.0-3.6'	Brown SILT, SAND, some gravel, pebbles, trace	
4__	s1	Bkg.				clay, poorly sorted, crumbly.	
		Bkg.		Moist	4.0-5.7'	Light brown to gray-brown SILT, some sand, clay,	96
_	s2	Bkg.				little-trace pebbles/ gravel, poorly sorted.	
		Bkg.			5.7-6.0'	Brown sandy GRAVEL, some fines, rounded gravel,	
_	s2	Bkg.	SB-06-6.0-00			percentage of gravel increasing toward bottom of	
		Bkg.				interval.	
_	s2	Bkg.			6.0-6.3'	Iron nodule 24-28".	
		Bkg.		Moist	6.3-6.9'	Gray to brown SILT, some clay, fine to coarse sandy	
8__	s2	Bkg.				pebbles, poorly sorted, slightly plastic.	
		Bkg.		Moist	6.9-7.2'	Weathered SANDSTONE, some fine sand.	38
_	s3	Bkg.				Pushing sandstone/gravel, stuck in bottom of spoon.	
		Bkg.		Moist	8.0-9.5'	Orange-brown sandy SILT, little gravel, clay,	
_	s3	Bkg.	No Sample			slightly plastic.	
		Bkg.					
_	s3	Bkg.					
		Bkg.					
12__	s3	Bkg.					
						Total depth of Geoprobe - 12.0 ft bgs.	
_							
_							
_							

Note: **Geoprobe samples are collected continuously in 4-foot sections using disposable liner.**

WESTON	SOIL BORING LOG	PAGE 1 OF 1	
Job Name	Ekco World Kitchen Housewares	Boring No.	SB-07-00
Date Drilled	21 September 2000	Boring Method	Geoprobe Rig
Drilling Co.	Frontz Drilling	Completion Depth	7.7 ft bgs
Drill Foreman	Jamie Foth	Location	Ekco Facility, Massillon, Ohio
Logged By	Dave Cairns, Greg Flasinski		

Depth (feet)	Sample No.	OVM Reading	Laboratory Sample ID	Moisture		Visual Description	% Rec
		Bkg.		Sl. Moist	0-1.0'	Gray to dark brown sandy GRAVEL, some clay,	
	s1	Bkg.				loose.	67
		Bkg.		Sl. Moist	1.0-2.0'	Upper 2" - gray-brown CLAY, some silt, brittle.	
	s1	5 ppm	SB-07-2.0-00			Lower 22" - Gray to brown sandy GRAVEL, some silt,	
		Bkg.				poorly sorted, loose.	
	s1	Bkg.			2.0-2.2'	Black gravely SAND, trace fines, loose, no odor,	
		Bkg.				(some type of FILL material?)	
4	s1	Bkg.			2.2-2.8'	Gray-brown sandy SILT, trace gravel, loose.	
		Bkg.				(natural material).	88
	s2	Bkg.		Sl. Moist	4.0-7.5'	Same as above, gray-brown SILT / weathered SHALE,	
		Bkg.		to dry		more competent toward bottom of interval. Collected	
	s2	Bkg.				sample from just above the tightest zone.	
		Bkg.					
	s2	Bkg.					
		Bkg.	SB-07-7.5-00				
8							
						Total depth of Geoprobe - 7.7 ft bgs. (refusal)	
12							

Note: **SB-07-00 was drilled in the vicinity of the former SB-07 (1991)**

Geoprobe samples are collected continuously in 4-foot sections using disposable liner.

WESTON — **SOIL BORING LOG**

Job Name	Ekco World Kitchen Housewares	**Boring No.**	SB-08-00
Date Drilled	21 September 2000	**Boring Method**	Geoprobe Rig
Drilling Co.	Frontz Drilling	**Completion Depth**	7.0 ft bgs
Drill Foreman	Jamie Foth	**Location**	Ekco Facility, Massillon, Ohio
Logged By	Dave Cairns, Greg Flasinski		

Depth (feet)	Sample No.	OVM Reading	Laboratory Sample ID	Moisture	Interval	Visual Description	% Rec
		Bkg.		Sl. Moist	0-1.7'	Brown gravelly SAND (FILL), higher percentage of	
	s1	Bkg.				gravel at top of interval, trace fines, loose.	60
		Bkg.		Dry	1.7-2.05'	Gray-white SANDSTONE/ GRAVEL layer (FILL)	
	s1	Bkg.	SB-08-2.0-00			weathered, loose.	
		Bkg.				(Sample was taken just above this gravel layer, soil	
	s1	Bkg.				appeared to be slightly stained, no odor).	
		Bkg.		Dry -	2.05-2.4'	Gray-brown to brown sandy SILT, fine sand, little	
4	s1	Bkg.		Sl. Moist		clay, friable.	
		Bkg.		Sl. Moist	4.0-5.0'	Orange-brown gravelly SAND, trace silt, loose (FILL).	100
	s2	Bkg.			5.0-5.1'	SANDSTONE Gravel layer (FILL).	
		Bkg.		Sl. Moist	5.1-6.0'	FILL - Lt. Gray-white to brown gravelly SAND,	
	s2	Bkg.				trace fines, loose.	
		Bkg.	SB-08-6.5-00	Moist	6.0-7.0'	lt. Gray-white SILT, some sand, trace clay and small	
	s2	Bkg.				pebbles, loose.	
						Total depth of Geoprobe - 7.0 ft bgs. (refusal)	
8							
12							

Note: **SB-08-00 was drilled in the vicinity of the former SB-13 (1988)**

Geoprobe samples are collected continuously in 4-foot sections using disposable liner.

WESTON	SOIL BORING LOG		PAGE 1 OF 1
Job Name	**Ekco World Kitchen Housewares**	**Boring No.**	**SB-09-00**
Date Drilled	21 September 2000	**Boring Method**	Geoprobe Rig
Drilling Co.	Frontz Drilling	**Completion Depth**	11.0 ft bgs
Drill Foreman	Jamie Foth	**Location**	Ekco Facility, Massillon, Ohio
Logged By	Dave Cairns, Greg Flasinski		

Depth (feet)	Sample No.	OVM Reading	Laboratory Sample ID	Moisture	Visual Description	% Rec
		Bkg.		Moist	0-1.0' brown sandy GRAVEL rades to a gravelly SAND,	
_	s1	Bkg.			(FILL), loose	46
		Bkg.	SB-09-1.5-00		1.0-1.9' Gray-brown sandy GRAVEL (FILL), some zones are a	
_	s1	Bkg.			dark gray color in this interval, trace fines, loose.	
		Bkg.				
_	s1	Bkg.				
		Bkg.				
4	s1	Bkg.				
		Bkg.		Wet	4.0-5.1' Dark gray to brown gravelly SAND to sandy GRAVEL	27
_	s2	Bkg.			(FILL).	
		Bkg.	SB-09-5.5-00			
_	s2	Bkg.				
		Bkg.				
_	s2	Bkg.				
		Bkg.				
8	s2	Bkg.				
		30 ppm			8.0-10.5' Gray weathered SHALE, more competent throughout	83
_	s3				interval, hard but friable in bottom of interval.	
		17 ppm			Highest readings on the OVM were just above this	
_	s3	25 ppm	SB-09-10.0-00		zone.	
		70 ppm				
_	s3	Bkg.				
					Total depth of Geoprobe - 11.0 ft bgs. (refusal)	
12						
_						
_						
_						

Note: **SB-09-00 was drilled in the vicinity of the former SB-06 (1991)**

Geoprobe samples are collected continuously in 4-foot sections using disposable liner.

WESTON	SOIL BORING LOG		PAGE 1 OF 1
Job Name	**Ekco World Kitchen Housewares**	**Boring No.**	**SB-10-00**
Date Drilled	21 September 2000	**Boring Method**	Geoprobe Rig
Drilling Co.	Frontz Drilling	**Completion Depth**	11.0 ft bgs
Drill Foreman	Jamie Foth	**Location**	Ekco Facility, Massillon, Ohio
Logged By	Dave Cairns, Greg Flasinski		

Depth (feet)	Sample No.	OVM Reading	Laboratory Sample ID	Moisture		Visual Description	% Rec
		Bkg.		Moist	0-1.2'	Brown sandy GRAVEL, some pieces of	
_	s1	Bkg.				Limestone/Sandstone gravel. Moist- wet from the	48
		Bkg.				water that was introduced during the coring process.	
_	s1	Bkg.	SB-10-2.0-00		1.2-1.7'	Several pieces of Limestone/Sandstone gravel with	
		Bkg.				some sand/silt.	
_	s1	Bkg.		Moist	1.7-1.95'	Brown SAND (fine), some silt, loose.	
		Bkg.					
4_	s1	Bkg.					
		Bkg.			4.0-6.0'	Brown SAND, fine to medium grained, FILL, some	90
_	s2	Bkg.				gravel.	
		Bkg.					
_	s2	Bkg.					
		Bkg.		Moist	6.0-7.3'	Gray to brown clayey SILT (natural), non-plastic,	
_	s2	Bkg.				trace fine pebbles and sand.	
		Bkg.	SB-10-7.5-00	Sl. Moist	7.3-7.6'	Gray weathered SHALE, highly weathered.	
8_	s2	Bkg.					
		Bkg.			8.0-11.0'	Gray highly weathered SHALE, very bottom of	100
_	s3	Bkg.				zone is more competent shale, a few relief bedding	
		Bkg.				planes are visible.	
_	s3	Bkg.	SB-10-10.0-00				
		Bkg.	(MS/MSD)				
_	s3	Bkg.					
						Total depth of Geoprobe - 11.0 ft bgs. (refusal)	
12_							
_							
_							
_							

Note: **Geoprobe samples are collected continuously in 4-foot sections using disposable liner.**

WESTON		SOIL BORING LOG	PAGE 1 OF 1
Job Name	**Ekco World Kitchen Housewares**	**Boring No.**	**SB-11-00**
Date Drilled	21 September 2000	**Boring Method**	Geoprobe Rig
Drilling Co.	Frontz Drilling	**Completion Depth**	15.0 ft bgs
Drill Foreman	Jamie Foth	**Location**	Ekco Facility, Massillon, Ohio
Logged By	Dave Cairns, Greg Flasinski		

Depth (feet)	Sample No.	OVM Reading	Laboratory Sample ID	Moisture		Visual Description	% Rec
		Bkg.			0-0.6'	Dark gray gravelly SILT, high percentage gravel at	
_	s1	Bkg.				top, some sand.	67
		Bkg.		Moist	0.6-1.4'	Gray-brown SILT, some clay, trace pebbles and	
_	s1	Bkg.				sand (FILL).	
		Bkg.	SB-11-2.5-00	Sl. Moist	1.4-2.3'	Brown SILT and GRAVEL, trace sand and clay,	
_	s1					non-plastic.	
				Sl. Moist	2.3-2.7'	Brown SAND, fine to medium grained, trace pebbles,	
4__	s1					loose.	
		Bkg.		Sl. Moist	4.0-5.3'	Brown silty CLAY, trace sand and pebbles, plastic	67
_	s2	Bkg.		Moist	5.3-6.0'	Gray-brown sandy SILT, some clay, some pebbles,	
		Bkg.				plastic.	
_	s2	Bkg.	SB-11-6.0-00				
		Bkg.		Moist	6.0-6.7'	Brown SILT., some sand, large piece of gravel in	
_	s2					bottom of spoon, slightly plastic.	
8__	s2						
		Bkg.		Moist	8.0-9.5'	Varigated light brown, brown-gray, gray-brown silty	67
_	s3	0.1 ppm				CLAY, some pebbles and sand, poorly sorted, plastic.	
		9 ppm			9.5-10.3'	Brown gravelly SAND, angular gravel, loose, possible	
_	s3	16 ppm				staining at bottom of interval.	
		16 ppm	SB-11-10.5-00		10.3-12.3'	Gray CLAY, trace silt, sand, small pebbles, soft,	
_	s3					plastic.	
12__	s3						
		20 ppm			12.3-12.7'	Grades to a light gray-brown CLAY.	67
_	s4	83 ppm			12.7-12.9'	Weathered SANDSTONE, fracturing horizontal.	
		5 ppm			12.9-13.5'	Brown silty SAND, some iron staining on small pebbles.	
_	s4	20 ppm	SB-11-14.0-00	Moist	13.5-14.5'	Orange-brown to brown silty CLAY, some sand,	
		15 ppm				rounded gravel, poorly sorted, slightly plastic.	
_	s4				14.5-15.0'	Brown SANDSTONE.	
						Total depth of Geoprobe - 15.0 ft bgs.	

Note: **Geoprobe samples are collected continuously in 4-foot sections using disposable liner.**

WESTON	SOIL BORING LOG	PAGE 1 OF 1	
Job Name	**Ekco World Kitchen Housewares**	**Boring No.**	**SB-12-00**
Date Drilled	21 September 2000	**Boring Method**	Geoprobe Rig
Drilling Co.	Frontz Drilling	**Completion Depth**	15.0 ft bgs
Drill Foreman	Jamie Foth	**Location**	Ekco Facility, Massillon, Ohio
Logged By	Dave Cairns, Greg Flasinski		

Depth (feet)	Sample No.	OVM Reading	Laboratory Sample ID	Moisture		Visual Description	% Rec
		Bkg.		Moist	0-0.7'	Gray silty CLAY, some sand and pebbles/ small	
_	s1	Bkg.				gravel, non plastic, moist to wet from water that was	75
		Bkg.				introduced during the coring process.	
_	s1	Bkg.	SB-12-2.0-00	Sl. Moist	0.7-1.5'	Gray to brown SAND, some pebbles / small gravel,	
		Bkg.				trace fines, loose.	
_	s1	Bkg.			1.5-4.6'	Gray-brown CLAY and SILT, little pebbles, sand,	
						poorly sorted (TILL?), slightly plastic, soft.	
4__	s1						
		Bkg.			4.6-4.7'	Gray-white SAND, fine to medium grained, some	75
_	s2	Bkg.				pebbles, weathered sandstone.	
		Bkg.		Moist	4.7-5.7'	Gray-brown CLAY, some silt, trace fine sand,	
_	s2	Bkg.				soft, slightly plastic	
		Bkg.	SB-12-6.3-00		5.7-6.3'	Light brown-white weathered SANDSTONE, (some	
_	s2	Bkg.				sandstone gravel), trace fines.	
					6.3-7.0'	Brown CLAY, little silt, trace sand and small gravel,	
8__	s2					moderately soft, slightly plastic.	
		Bkg.		Moist -	8.0-11.0'	Medium gray CLAY, trace silt, Clay ranges from firm	75
_	s3	Bkg.		Sl. moist		to crumbly, other areas soft and plastic, no coarse	
		Bkg.				material.	
_	s3	0.1 ppm	SB-12-10-00				
_	s3						
12__	s3						
		Bkg.		Moist	12.0-13.0'	Gray-brown CLAY, trace silt, plastic.	94
_	s4	Bkg.			13.0-13.1'	Gray-white weathered SANDSTONE gravel.	
		Bkg.		Moist	13.1-13.9'	Gray-brown gravely SILT/CLAY, some sand,	
_	s4	13 ppm	SB-12-14.0-00			slightly plastic.	
					13.9-14.0'	Iron coated nodule - (gravel).	
_	s4				14.0-14.5'	TILL, as above.	
					14.5-14.8'	Weathered SANDSTONE gravel.	

Total depth of Geoprobe - 15.0 ft bgs.

Note: **SB-12-00 was drilled as close as possible (~15') to the former SB-11 (1991)**

Geoprobe samples are collected continuously in 4-foot sections using disposable liner.

WESTON	SOIL BORING LOG	PAGE 1 OF 1

Job Name	**Ekco World Kitchen Housewares**	**Boring No.**	**SB-13-00**
Date Drilled	21 September 2000	**Boring Method**	Geoprobe Rig
Drilling Co.	Frontz Drilling	**Completion Depth**	9.0 ft bgs
Drill Foreman	Jamie Foth	**Location**	Ekco Facility, Massillon, Ohio
Logged By	Dave Cairns, Greg Flasinski		

Depth (feet)	Sample No.	OVM Reading	Laboratory Sample ID	Moisture		Visual Description	% Rec
		240 ppm		Moist -	0-0.7'	Gray sandy GRAVEL (FILL), loose, Moist to wet from	
_	s1	300 ppm		Wet		water that was introduced during the coring process.	75
		345 ppm	SB-13-1.2-00		0.7-1.75'	Gray to brown clayey SILT, trace sand and gravel,	
_	s1	200 ppm	(DUP)			small area possibly stained (sample was collected here).	
		100 ppm		Sl. Moist	1.75-2.3'	Brown silty GRAVEL, (FILL) gravel rounded -	
_	s1	105 ppm				some pieces broken, loose.	
					2.3-3.0'	Gray-brown clayey SILT, moderately firm, little sand	
4	s1					and iron coated gravel (Natural?)	
		Bkg.		Moist	4.0-7.0'	Interval poorly sorted silty CLAY, some sand, gravel,	73
_	s2	Bkg.	SB-13-5.0-00			few iron coated pebbles, moderately firm, plastic.	
		Bkg.					
_	s2	Bkg.					
		Bkg.					
_	s2	Bkg.					
		Bkg.					
8	s2	Bkg.					
		179 ppm			8.0-8.45'	Silty CLAY, as above, higher percentage of gravel	100
_	s3	285 ppm	SB-13-9.0-00			throughout interval.	
					8.45-8.9'	Gray weathered SHALE, some shale gravel, shale	
_						weathered to a gray clay.	
					8.9-9.0'	Gray SHALE, too hard to penetrate.	
_						Total depth of Geoprobe - 9.0 ft bgs. (refusal)	
12							
_							
_							
_							

Note: **Geoprobe samples are collected continuously in 4-foot sections using disposable liner.**

Job Name	Ekco World Kitchen Housewares	Boring No.	SB-14-00
Date Drilled	21 September 2000	Boring Method	Geoprobe Rig
Drilling Co.	Frontz Drilling	Completion Depth	19.8 ft bgs
Drill Foreman	Jamie Foth	Location	Ekco Facility, Massillon, Ohio
Logged By	Dave Cairns, Greg Flasinski		

Depth (feet)	Sample No.	OVM Reading	Laboratory Sample ID	Moisture		Visual Description	% Rec
		26 ppm			0-1.0'	Brown-black-gray sandy GRAVEL, FILL, hard in	
_	s1	40 ppm	SB-14-1.0-00			some areas, crumbly in others.	75
		43 ppm			1.0-2.75'	Dark brown gravelly SAND, gravel small in diameter,	
_	s1	37 ppm				some areas have higher percentage of fines.	
_	s1				3.0'	Hit SANDSTONE gravel - plugged core barrel.	
4__							
		Bkg.			4-5.0'	Light gray-brown highly weathered SANDSTONE,	75
_	s2	9 ppm				loose, (FILL?)	
		75 ppm	SB-14-5.5-00	Sl. Moist	5.0-6.5'	Dark gray-brown CLAY, some sand, small gravel, silt,	
_	s2	12 ppm	(DUP)			poorly sorted, plastic.	
		24 ppm					
_	s2	22 ppm					
8__	s2						
		24 ppm		Moist	8.0-8.3'	Brown gravelly CLAY, some silt, trace sand,	63
_	s3	54 ppm				moderately firm, plastic, gravel is rounded.	
		35 ppm		Moist-wet	8.3-9.7'	Light gray-brown SANDSTONE, no fines.	
_	s3	52 ppm		Moist	9.7-13.3'	Gray CLAY, trace silt and fine sand, plastic.	
		74 ppm	SB-14-10.5-00				
_	s3						
12__	s3						
		27 ppm					100
_	s4	66 ppm					
		98 ppm		Moist-wet	13.3-13.7'	Gray SAND (fine-medium), little silt, loose	
_	s4	131 ppm			13.7-14.6'	Gray CLAY, trace sand, moderately hard, plastic, a	
		104 ppm				few plant roots in interval.	
_	s4	186 ppm	SB-14-15.0-00		14.6-15.0'	Gray highly weathered SHALE, abundant small pieces	
		51 ppm				of broken shale, friable to moderately hard.	

Note: **Geoprobe samples are collected continuously in 4-foot sections using disposable liner.**

(Continued on page 2.)

WESTON	SOIL BORING LOG	PAGE 2 OF 2

Job Name	Ekco World Kitchen Housewares	Boring No.	SB-14-00

Depth (feet)	Sample No.	OVM Reading	Laboratory Sample ID	Moisture		Visual Description	% Rec
16	s4	152 ppm		Moist	15.0-17.3'	Gray gravelly CLAY, moderately hard, gravel is small	
		71 ppm				and rounded, plastic. Some interbedded coarse	92
	s5	116 ppm		Moist-wet		sand zones.	
		135 ppm		Moist	17.3-18.2'	Dark gray SAND (fine to coarse) and GRAVEL,	
	s5	256 ppm				trace to little fines, loose, odor.	
		234 ppm			18.2-19.7'	Gray-brown SAND grading to a highly weathered	
	s5	147 ppm				SANDSTONE in bottom of interval.	
		429 ppm	SB-14-19.5-00				
20	s5						
					Total depth of Geoprobe - 19.8 ft bgs. (refusal)		

WESTON	SOIL BORING LOG		PAGE 1 OF 1
Job Name	Ekco World Kitchen Housewares	Boring No.	SB-15-00
Date Drilled	22 September 2000	Boring Method	Geoprobe Rig
Drilling Co.	Frontz Drilling	Completion Depth	9.0 ft bgs
Drill Foreman	Jamie Foth	Location	Ekco Facility, Massillon, Ohio
Logged By	Dave Cairns, Greg Flasinski		

Depth (feet)	Sample No.	OVM Reading	Laboratory Sample ID	Moisture		Visual Description	% Rec
		Bkg.		Sl. Moist	0-1.1'	Gray sandy GRAVEL (FILL), loose, trace fines.	
_	s1	Bkg.		Moist	1.1-1.9'	Dark gray GRAVEL, some sand and silt, loose.	75
		Bkg.					
_	s1	Bkg.		Moist	1.9-2.3'	Dark orange-brown sandy SILT, some clay, fine	
		Bkg.	SB-15-2.6-00			gravel, slightly plastic	
_	s1	Bkg.			2.3-4.25'	Medium brown SILT, some clay, little sand, soft,	
						plastic.	
4__	s1						
		Bkg.		Moist	4.25-9.0'	Gray CLAY / highly weathered SHALE, relict	79
_	s2	Bkg.				bedding visible - almost horizontal.	
		Bkg.					
_	s2	Bkg.					
		Bkg.	SB-15-6.5-00				
_	s2	Bkg.					
		Bkg.					
8__	s2						
		Bkg.			The acetate liner for this interval was saturated, therefore no sample		
_	s3	Bkg.	No sample		was collected.		
					Total depth of Geoprobe - 9.0 ft bgs. (refusal)		
_							
_							
12__							
_							
_							
_							

Note: **Geoprobe samples are collected continuously in 4-foot sections using disposable liner.**

WESTON	SOIL BORING LOG	PAGE 1 OF 1	
Job Name	**Ekco World Kitchen Housewares**	**Boring No.**	**SB-16-00**
Date Drilled	22 September 2000	**Boring Method**	Geoprobe Rig
Drilling Co.	Frontz Drilling	**Completion Depth**	9.0 ft bgs
Drill Foreman	Jamie Foth	**Location**	Ekco Facility, Massillon, Ohio
Logged By	Dave Cairns, Greg Flasinski		

Depth (feet)	Sample No.	OVM Reading	Laboratory Sample ID	Moisture		Visual Description	% Rec
		Bkg.		Sl. Moist	0-1.1'	Gray GRAVEL (FILL), some sand, trace fines, loose.	
_	s1	Bkg.		Moist	1.1-2.0'	Dark brown SILT, some gravel, sand, FILL.	88
		Bkg.					
_	s1	Bkg.	SB-16-2.0-00		2.0-3.25'	Gray highly weathered SHALE (natural), moderately	
		Bkg.				hard.	
_	s1	Bkg.		Moist	3.25-3.5'	Gray-brown gravelly CLAY, some silt, little sand,	
						moderately soft, slightly plastic.	
4	s1						
		Bkg.		Sl. Moist	4.0-5.0'	Gray to light brown CLAY, moderately hard, trace	92
_	s2	Bkg.				silt, no coarse material, plastic.	
		Bkg.			5.0-6.25'	CLAY, as above with two 0.5" lenses of	
_	s2	Bkg.				weathered SHALE, also brown CLAY.	
		Bkg.		Moist-wet	6.25-9.0'	Gray highly weathered SHALE, friable, moist to wet	
_	s2	Bkg.				at top of the weathered shale.	
		8 ppm	SB-16-7.5-00				
8	s2						
							100
_	s3	170 ppm	No sample				
						Total depth of Geoprobe - 9.0 ft bgs. (refusal)	
_							
_							
12							
_							
_							
_							

Note: **SB-16-00 was drilled in the vicinity of the former SB-11 (1988)**

Geoprobe samples are collected continuously in 4-foot sections using disposable liner.

WESTON	SOIL BORING LOG	PAGE 1 OF 1	
Job Name	**Ekco World Kitchen Housewares**	**Boring No.**	**SB-17-00**
Date Drilled	22 September 2000	**Boring Method**	Geoprobe Rig
Drilling Co.	Frontz Drilling	**Completion Depth**	7.3 ft bgs
Drill Foreman	Jamie Foth	**Location**	Ekco Facility, Massillon, Ohio
Logged By	Dave Cairns, Greg Flasinski		

Depth (feet)	Sample No.	OVM Reading	Laboratory Sample ID	Moisture		Visual Description	% Rec
		Bkg.		Sl. Moist	0-1.1'	Gray brown silty GRAVEL, some plant roots at top,	
	s1	Bkg.				loose, (FILL).	75
		Bkg.			1.1-3.0'	Gray SILT, some clay, trace pebbles and small	
	s1	Bkg.	SB-17-2.0-00			gravel, crumbly, slightly plastic.	
		Bkg.					
	s1	Bkg.					
4	s1						
		Bkg.		Sl. Moist	4.0-4.6'	Gray SILT / CLAY, slightly plastic.	83
	s2	Bkg.			4.6-7.3'	Gray highly weathered SCHIST, very bottom of interval	
		Bkg.				is fairly competent schist.	
	s2	17 ppm	SB-17-6.0-00				
		Bkg.					
	s2	Bkg.					
		8 ppm					
8							
						Total depth of Geoprobe - 7.3 ft bgs. (refusal)	
12							

Note: **Geoprobe samples are collected continuously in 4-foot sections using disposable liner.**

WESTON	SOIL BORING LOG	PAGE 1 OF 1

Job Name	**Ekco World Kitchen Housewares**	**Boring No.**	**SB-18-00**
Date Drilled	22 September 2000	**Boring Method**	Geoprobe Rig
Drilling Co.	Frontz Drilling	**Completion Depth**	7.3 ft bgs
Drill Foreman	Jamie Foth	**Location**	Ekco Facility, Massillon, Ohio
Logged By	Dave Cairns, Greg Flasinski		

Depth (feet)	Sample No.	OVM Reading	Laboratory Sample ID	Moisture		Visual Description	% Rec
		Bkg.		Sl. Moist	0-1.1'	Gray GRAVEL (FILL), some sand, loose.	
	s1	Bkg.		Moist	1.1-2.6'	Dark gray to black CLAY, some small gravel/pebbles,	85
		Bkg.				sand, plastic.	
	s1	Bkg.					
		Bkg.	SB-18-2.5-00		2.6-2.95'	WOOD fragments (FILL). Sample taken just below	
	s1	Bkg.				WOOD fragments.	
		Bkg.		Dry -	2.95-5.7'	Gray-brown SILT, little clay, very fine sand, crumbly.	
4	s1	Bkg.		Sl. Moist			
		Bkg.					83
	s2	Bkg.					
		Bkg.		Moist-	5.7-7.3'	Gray highly weathered SHALE, crumbly, more	
	s2	Bkg.		wet		competent with depth, very bottom is a piece of	
		Bkg.				SHALE with some SILT.	
	s2	Bkg.	SB-18-7.0-00				
		Bkg.					
8	s2						
						Total depth of Geoprobe - 7.3 ft bgs. (refusal)	
12							

Note: **SB-18-00 was drilled in the vicinity of the former SB-10 (1988)**

Geoprobe samples are collected continuously in 4-foot sections using disposable liner.

WESTON	SOIL BORING LOG		PAGE 1 OF 1
Job Name	**Ekco World Kitchen Housewares**	**Boring No.**	**SB-19-00**
Date Drilled	22 September 2000	**Boring Method**	Geoprobe Rig
Drilling Co.	Frontz Drilling	**Completion Depth**	7.3 ft bgs
Drill Foreman	Jamie Foth	**Location**	Ekco Facility, Massillon, Ohio
Logged By	Dave Cairns, Greg Flasinski		

Depth (feet)	Sample No.	OVM Reading	Laboratory Sample ID	Moisture	Visual Description	% Rec
		Bkg.		Sl. Moist	0-0.7' Dark gray-black gravelly SILT, Limestone gravel at top of interval, piece of asphalt near bottom of interval, loose.	92
_	s1	Bkg.				
		Bkg.				
_	s1	Bkg.		Moist	0.7-1.0' Brown sandy CLAY, some silt, slightly plastic, poorly sorted.	
		Bkg.				
_	s1	Bkg.	SB-19-3.0-00	Moist	1.0-1.7' Dark brown to black sandy SILT (FILL), crumbly.	
		Bkg.	(DUP)	Moist	1.7-1.95' Brown SANDSTONE fragments (fine to medium), crumbly.	
4__	s1	Bkg.				
		Bkg.		Moist	1.95-3.7' Dark brown to black sandy SILT (FILL), crumbly.	83
_	s2	Bkg.		Moist-wet	4.0-7.3' Interval is all FILL, primarily a black SILT with some clay, gravel, some rock fragments throughout interval, slightly plastic.	
		Bkg.				
_	s2	Bkg.	SB-19-6.0-00			
		Bkg.				
_	s2	Bkg.				
		Bkg.				
8__	s2					
					Total depth of Geoprobe - 7.3 ft bgs. (refusal)	
_						
_						
_						
12__						
_						
_						
_						

Note: **Geoprobe samples are collected continuously in 4-foot sections using disposable liner.**

WESTON
MANAGERS DESIGNERS CONSULTANTS

DRAFT
ADDENDUM TO THE CORRECTIVE MEASURES STUDY

EKCO HOUSEWARES, INC.
MASSILLON, OHIO

July 1994

Received July 5, 94
SA

DRAFT
ADDENDUM TO THE CORRECTIVE MEASURES STUDY

EKCO HOUSEWARES, INC.
MASSILLON, OHIO

July 1994

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1 July 1994

Ms. Sally Ann Averill
Project Manager
Office of RCRA (HRE-8J)
U.S. EPA Region 5
77 West Jackson Blvd.
Chicago, IL 60604-3590

W.O. 02994-002-005

RE: CMS Addendum
EKCO Housewares, Inc., Massillon, Ohio

Dear Ms. Averill:

On behalf of American Home Products Corporation, Roy F. Weston, Inc. (WESTON) is submitting three (3) copies of the *Draft Addendum to the CMS Report* for the EKCO Housewares, Inc. facility in Massillon, Ohio. This report presents the findings of WESTON's analysis of the following alternatives for groundwater remediation:

- GW-4: Pulse pumping of wells W-1 and W-10 only.
- GW-5: Use of overburden recovery wells and pulse pumping of wells W-1 and W-10.
- GW-6: Air sparging within shallow zone and pulse pumping of W-1 and W-10.

WESTON also reexamined the capital cost and the operating and maintenance cost estimates for alternatives GW-2 and GW-3. The updated costs are summarized in Table 6-2.

If there are additional questions, please contact Patricia McDonald at (201) 660-5590 or me at (610) 701-3020.

Very truly yours,

ROY F. WESTON, INC.

Lawrence J. Bove

Lawrence J. Bove, P.E.
Principal Project Manager

Attachments

cc: P. McDonald - AHPC

1063.mtl

WESTON MANAGERS DESIGNERS CONSULTANTS

DRAFT
ADDENDUM TO THE CORRECTIVE MEASURES STUDY

EKCO HOUSEWARES, INC.
MASSILLON, OHIO

July 1994

Prepared for

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Work Order No. 02994-002-005

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WESTON
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SECTION 1
DESCRIPTION OF CURRENT SITUATION

1.1 PROJECT OVERVIEW

This addendum contains the results of the re-evaluation of the findings of the Corrective Measures Study (CMS) for the EKCO Housewares, Inc. (EKCO) facility in Massillon, Ohio. Additional groundwater corrective measures alternatives are presented herein. The CMS findings were revised as a result of interim remedial measures (IRM) activities for well rehabilitation at the EKCO facility. Water level measurements collected following well rehabilitation indicated that hydraulic control of overburden groundwater was maintained. It was recommended that enhanced remediation of the overburden groundwater be investigated.

1.1.1 Background

Roy F. Weston, Inc. (WESTON®) was contracted in 1991 to conduct a Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) for the EKCO facility CMS. This work is being performed in accordance with an Administrative Order on Consent (Consent Order), signed between EKCO, Inc. and the U.S. Environmental Protection Agency (EPA) in March/April 1989.

The Draft RFI Report was submitted to EPA in August 1992. EPA comments were subsequently received in April 1993. A Final RFI Report and written responses to EPA comments were submitted in May 1993. Additional EPA comments were received in July 1993. Revised pages of the Final RFI Report, as well as responses to these comments, were submitted to EPA on 10 August 1993. Most recently, a letter dated 3 November 1993, was received from EPA indicating agency approval of the RFI with modifications (attached to the letter).

The Draft CMS Report was initiated shortly after the revisions to the Final RFI Report and submitted to EPA on 30 September 1993. EPA comments on the Draft CMS Report, dated 21 October 1993, were received. The Final CMS Report was submitted to EPA on 24 November 1993. A letter dated 8 February 1994 was received from EPA indicating agency approval of the CMS.

In March and April 1994, WESTON performed well rehabilitation interim remedial measures (IRM) activities at the EKCO facility in accordance with the Draft IRM Work Plan approved by EPA in February 1994. This IRM was precipitated by a casing seat test performed on Well R-2 in April 1991, which indicated that the casing seal was leaking. The leaking seal allowed groundwater to migrate downward from the overburden water-bearing units, through the annulus around the casing, to the sandstone bedrock water-bearing zone in the open borehole, causing the following problems:

- The leaking casing seat provided a conduit for groundwater to migrate from the overburden units, which at Well I-2 currently contain approximately 2 mg/L of volatile organic compounds (VOCs), to the sandstone unit, which at Well R-2 currently contains approximately 14 μg/L of VOCs.
- The mixing of the overburden and bedrock groundwater at the well caused misrepresentative analytical groundwater sampling results in the bedrock unit.
- The hydraulic connection between the overburden and the bedrock caused by the leaking casing seat resulted in misrepresentative water levels, which could cause misinterpretation of groundwater flow.

The results of the RFI suggested that wells R-1, R-3, W-1, W-2, and W-10 may also have acted as conduits from the shallow and intermediate water-bearing units to the bedrock unit.

It was concluded in the CMS:

> "The implementation of this proposed interim remedial measure may impact the performance of the ongoing groundwater recovery system. The goal of the well rehabilitation measure is to reduce or eliminate hydraulic connections between the shallow and intermediate water-bearing units and the bedrock. The current system is preventing off-site migration of contaminants from the shallow, intermediate, and

> bedrock water-bearing units. The reduction or elimination of the existing hydraulic connections between the aquifers may reduce the current control of the shallow and intermediate water-bearing units using the production wells. The direction of the flow in these units may change, allowing contaminated groundwater to migrate off-site unless additional remedial actions are taken to control the shallow and intermediate water-bearing zones."

A summary of the CMS results is presented in Subsection 1.2. The results of the well rehabilitation IRM were presented in the *Draft Report, Interim Remedial Measures, EKCO Housewares Facility,* submitted to EPA in June 1994, and they are summarized in Section 2.

WESTON has re-evaluated the findings presented in the CMS based on the results of the well rehabilitation IRM. This CMS Addendum Report has been prepared to present the results of this re-evaluation.

1.2 SUMMARY OF CMS FINDINGS

1.2.1 Corrective Measures Objectives

Corrective measures objectives were developed in Section 2 of the CMS and are summarized below.

1.2.1.1 Groundwater

The corrective measures objectives for groundwater at the EKCO site are to:

- Achieve regulatory standards, i.e., maximum contaminant levels (MCLs), for organics found in all on-site aquifers.
- Continue to prevent the migration of contamination from the site.
- Achieve regulatory standards (MCLs) for organics found in any portion of the deep sand and gravel layer [which serves the Ohio Water Service (OWS) wells] that is adjacent to the site and has been impacted by it.

Contaminants found above their respective MCLs were PCE, TCE, 1,1-DCE, 1,2-DCE, vinyl chloride, and 1,1,1,-TCA. Action levels (MCLs) for the contaminants are:

- PCE — 0.005 mg/L
- TCE — 0.005 mg/L
- 1,1-DCE — 0.007 mg/L
- 1,2,-DCE — 0.07 (cis isomer) mg/L
- Vinyl chloride — 0.002 mg/L
- 1,1,1,-TCE — 0.2 mg/L

Because no isomeric breakdown analyses were performed, the cis isomer of 1,2,-DCE, which has a lower MCL than the trans isomer, was used.

Groundwater contamination exceeding these goals is present in on-site groundwater within the shallow, intermediate, and bedrock water-bearing zones.

1.2.1.2 Soils

Partition modeling of contaminants found in soil borings was performed to calculate soil cleanup goals that would not cause groundwater to exceed MCLs under current pumping conditions. Modeling consisted of using the respective contaminant MCL concentration, diluted by the shallow zone aquifer volume, to determine the maximum soil concentration, based on equilibrium partitioning between the soil and infiltrating precipitation. Soil cleanup goals calculated by this method were 1.0 and 10.0 mg/kg for TCE and 1,2-DCE, respectively.

Soils exceeding these cleanup levels were identified at the four areas as shown in Figure 1-1.

1.2.2 Remedial Action Alternatives

Remedial action alternatives were developed in Section 4 of the CMS Report and are summarized below.

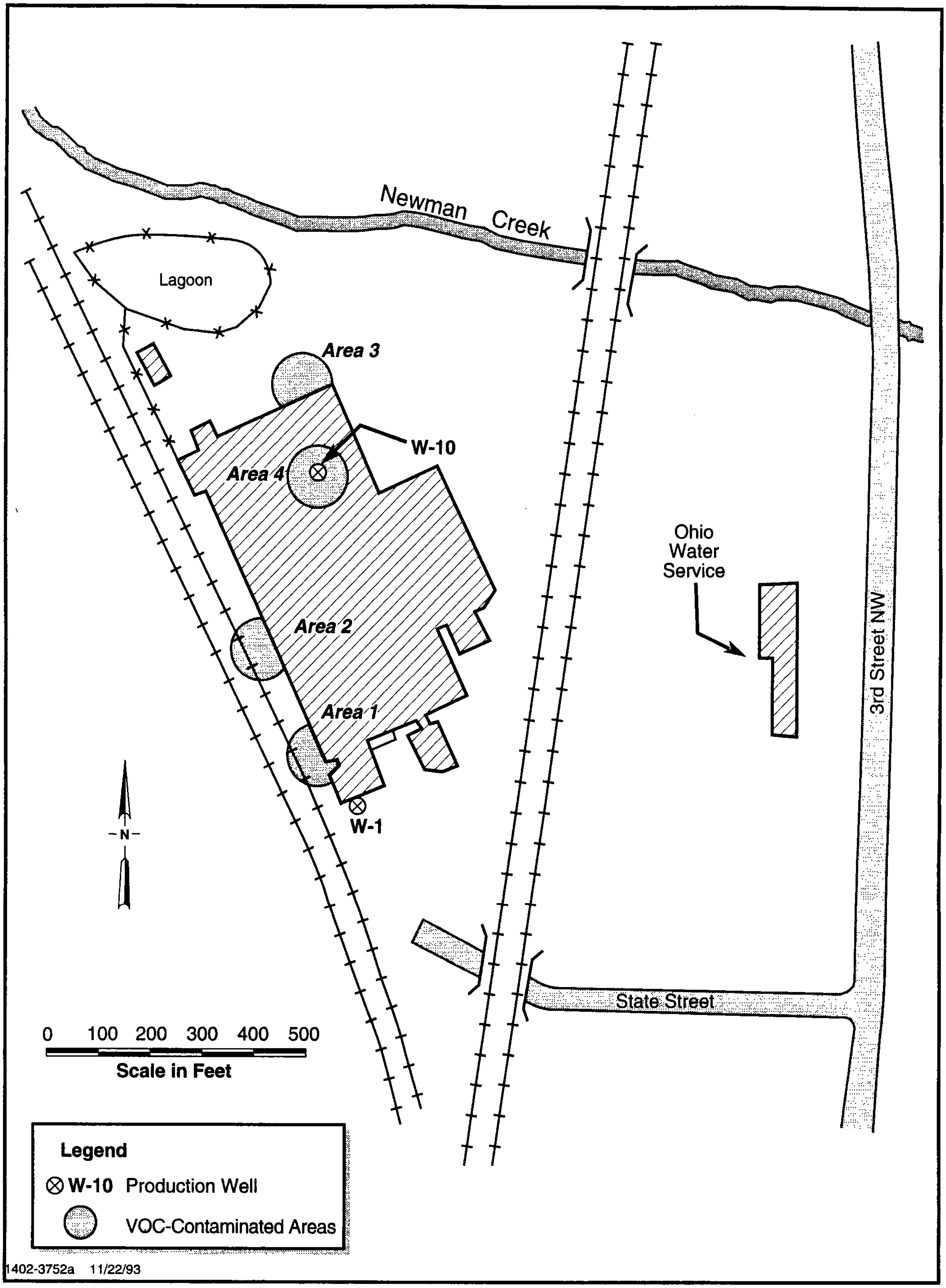

FIGURE 1-1 VOC-CONTAMINATED AREAS EXCEEDING SOIL CLEANUP GOALS

1.2.2.1 Groundwater Alternatives Developed for Evaluation

The following alternatives for groundwater remediation identified during the CMS are presented below:

- Alternative GW-1: No action — With the no action alternative, the current groundwater recovery operation would cease. Site groundwater would be uncontrolled. No groundwater monitoring would be performed.

- Alternative GW-2: Installation of additional recovery wells — Operation of the existing recovery wells, W-1 and W-10, would continue. An addition two recovery wells would be used to control groundwater in the shallow and intermediate water-bearing zones. The existing air stripper will be used to treat the recovered groundwater. Groundwater monitoring would be continued on a semi-annual basis. Wells not required for monitoring would be grouted/sealed.

- Alternative GW-3: Installation of additional recovery wells and pulse pumping of bedrock wells — Three additional recovery wells would be used to control groundwater in the shallow and intermediate water-bearing zones. Operation of the existing recovery system would be modified so that each of the recovery wells, W-1 and W-10, would be operated on an alternating (pulsed) basis. The average flow rate of the system would be reduced, and higher VOC removal rates are predicted. The object would be to increase the overall mass flow rate (i.e., pounds per year) of VOCs removed. The existing air stripper will be used to treat the recovered groundwater. Groundwater monitoring would be performed on a semi-annual basis. Wells not required for groundwater monitoring would be grouted/sealed.

1.2.2.2 Source-Corrective Alternatives for Soils Underneath the Building

It is estimated that 3,500 yd^3 of soils underneath the building are contaminated. The following alternatives for remediation of contaminated soils underneath the building identified during the CMS are presented below:

- Alternative IS-1 - No action — Under this alternative, no remedial action would be performed on the soils underneath the building.

- Alternative IS-2 - Soil vapor extraction (SVE) treatment — Under this alternative, an SVE system would be installed to remove VOCs from the soils underneath the building. Air injection vents and vertical recovery vents would be installed through the floor of the building. The removed VOCs would be treated using granular-activated carbon (GAC), if necessary. A pilot system would be installed and additional soil borings would be completed in the area to define the placement of vents for a full-scale system.

- Alternative IS-3 - Horizontal SVE treatment — Under this alternative, an SVE system would be installed to remove VOCs from the soil underneath the building. Air injection vents and recovery vents would be installed from outside the building and run horizontally underneath the building. The removed VOCs would be treated using GAC, if necessary. A pilot system would be installed and additional soil borings would be completed in the area to define the placement of vents for a full-scale system.

1.2.2.3 Source-Corrective Alternatives for Soils Outside the Building

It is estimated that 4,900 yd^3 of soil outside the building area are contaminated. The following alternatives for remediation of contaminated soils outside the building identified during the CMS are presented below:

- Alternative OS-1 - No action — Under this alternative, no remedial action would be performed on the soils outside the building.

- Alternative OS-2 - Fence and post warning signs — Under this alternative, areas outside the building that have soil contamination exceeding the proposed RCRA corrective action guidelines would be fenced and posted to prevent unauthorized contact.

- Alternative OS-3 - SVE — Under this alterative, an SVE system would be installed to remove VOCs from the three areas of soil contamination outside the building. Air injection vents and a combination of vertical and horizontal recovery vents would be installed in each area. The removed VOCs would be treated using GAC, if necessary. A pilot system would be installed and additional soil borings would be completed in the area to refine the placement of vents for a full-scale system.

- Alternative OS-4 - Ex situ volatilization — Under this alternative, the three areas of soil contamination outside the building would be excavated. This soil would be placed on an impervious surface for treatment. The VOCs would be removed through a series of pipes connected to a vacuum pump. The removed VOCs would be treated using GAC, if necessary. Following successful treatment, the soil would be returned to the excavation. Implementation of this approach would require the designation of a corrective action management unit (CAMU) at the facility.

- Alterative OS-5 - Low temperature thermal treatment — Under this alterative, the three areas of soil contamination outside the building would be excavated. This soil would be pretreated to remove any large debris. The soil would then be conveyed into the thermal treatment unit. The removed VOCs would be treated using GAC. Following successful treatment, the soil would be returned to the excavation. Implementation of this approach would require the designation of a CAMU at the facility.

- Alternative OS-6 - Off-site disposal/incineration — Under this alternative, the three areas of soil contamination outside the building would be excavated. This soil would be sent to either a hazardous waste landfill or incinerator, depending on whether the excavated soil meets the land disposal restrictions (LDRs).

1.2.3 Recommendation of Corrective Measures Alternatives

Three alternatives for groundwater were developed for detailed analysis. Alternative GW-1 (no action) does not meet the corrective measures objectives for groundwater, whereas alternatives GW-2 (installation of additional recovery wells and constant pumping of wells W-1 and W-10) and GW-3 (installation of additional recovery wells and pulse pumping of wells W-1 and W-10) could both meet the objectives depending on extraction well placement. Alternatives GW-2 and GW-3 meet the corrective measures objectives in functionally the same manner. Both act to contain groundwater using recovery wells that would control the shallow, intermediate, and bedrock water-bearing zones. Alternative GW-3 refines this approach by incorporating pulse pumping of the bedrock recovery wells. The existing data suggest that pulse pumping may serve to increase the level of VOCs in the recovered groundwater. This in turn may lead to a reduction in the time required to reduce site groundwater to regulatory standards. Therefore, it was recommended that alternative GW-3 be implemented.

Three alternatives were developed for soils underneath the building. Alternative IS-1 (no action) does not meet the corrective measures objectives for soils, whereas alternatives IS-2 (vertical SVE) and IS-3 (horizontal SVE) would both meet the objectives. Alternatives IS-2 and IS-3 meet the corrective measures objectives in functionally the same manner. With alternative IS-2, vents would be installed from within the building, through the floor. With alterative IS-3, the vents would be installed from outside the building. IS-3 is expected to have less potential impact on the facility operations, but IS-2 is more cost-effective. Therefore, it was recommended that alternative IS-2 be implemented.

- OS-1 — No action.
- OS-2 — Fence and post warning signs.
- OS-3 — Vertical SVE.
- OS-4 — Ex situ volatilization.
- OS-5 — Low temperature thermal treatment.
- OS-6 — Off-site disposal/incineration.

Alternatives OS-1 and OS-2 do not meet the corrective measures objectives, whereas the remaining alternatives do meet the objectives. Alternatives OS-3, OS-4, OS-5, and OS-6 (with incineration as the disposal option) act to reduce the volume of contaminated material, but alternative OS-6 (with landfill as the disposal option) achieves no reduction of waste volume or toxicity of the soils. Alternatives OS-4, OS-5, and OS-6 all require excavation of the soils, which could potentially volatilize the VOCs in the soils. Additionally, if soil contamination in Areas 1, 2, or 3 extends to and/or underneath the building, the alternatives that involve excavation would become difficult to fully implement and would require SVE. SVE is already the recommended alternative for Area 4 soils underneath the building and could be implemented in Areas 1, 2, and 3, if necessary. SVE is also a well proven technology for VOC-contaminated soils.

Based on these considerations, alternative OS-3 is recommended for soils outside the building.

In summary, the recommended alternatives for the EKCO facility were:

- GW-3 — Installation of additional overburden recovery wells and pulse-pumping of wells W-1 and W-10.

- IS-2 — Vertical SVE.

- OS-3 — Vertical SVE.

SECTION 2

WELL REHABILITATION INTERIM RESPONSE MEASURES

WESTON conducted well rehabilitation Interim Response Measure (IRM) activities at the EKCO facility from 21 March through 29 April 1994. This work was performed pursuant to the Draft IRM Work Plan, which was submitted to EPA Region V on behalf of American Home Products Corporation (AHPC) in December 1993 and approved by EPA Region V in February 1994. The results of these activities were submitted to EPA in the June 1994 *Draft Report Interim Remedial Measures* and are summarized below.

Rehabilitation of six on-site bedrock wells was performed by properly sealing the well casings against confining layers present in the side walls of the boreholes. This rehabilitation work was designed to eliminate interaquifer communication and contaminant migration between the shallow overburden aquifer and the bedrock aquifer beneath the site. The on-site bedrock wells requiring rehabilitation included production/recovery wells W-1 and W-10, out-of-service production well W-2, and monitor wells R-1, R-2, and R-3. Shallow overburden monitor well D-4-30 was abandoned by overdrilling and grouting the borehole in accordance with the Ohio Department of Natural Resources (ODNR) regulations for well abandonment. Because of the siltation problems associated with the poor condition of the wellhead seal and casing riser, the agency agreed with the need for abandonment of this well. Following completion of rehabilitation activities, monitoring of the groundwater levels in all aquifer units was performed to assess the extent to which the pumping of the site recovery wells continue to affect the aquifer gradients and capture zones.

The results of the post-rehabilitation groundwater monitoring indicated that the groundwater flow direction in the four primary water-bearing units in the area of the site continues to be toward the site production/recovery wells, W-1 and W-10. The most significant changes in groundwater levels occurred in the bedrock water-bearing zone. Specifically, the retrofitted R-wells exhibited significant drops in water level elevations, indicating that hydraulic communication to the overlying shallow water-bearing zone had been eliminated as a result of the IRM efforts. In general, all four of the water-bearing units experienced rising and falling water level trends during the month of April 1994 with the high water mark in the shallow zone occurring the week of 14 April, and the high water mark in the remaining three deeper water-bearing units occurring the week of 20 April. The fluctuations in water levels appear to be the result of the heavy precipitation that occurred during this period, and the week of delayed recharge to the three deeper water-bearing units is typical for semiconfined and confined aquifers.

2.1 SHALLOW SAND AND GRAVEL UNIT RESULTS

The groundwater contour map for the shallow sand and gravel indicates that the groundwater flow direction in this unit continues to be toward site recovery wells W-1 and W-10 (Figure 2-1). In the northern portion of the site, the calculated horizontal hydraulic gradients ranged from 0.022 to 0.030 ft/ft. A portion of the hydraulic gradient in this northern area of the site may be attributable to natural gradients flowing away from Newman Creek both to the north and south. Comparison of staff gauge measurements in the creek to shallow wells in this area suggests the creek is a losing stream. In the southern portion of the site, the calculated horizontal hydraulic gradient was approximately 0.039 ft/ft. In the southern portion of the site, the shallow groundwater gradients appear to be influenced by the pumping of the on-site recovery wells because the erosional bedrock surface subcrops in contact with the shallow overburden units in the area of the southern site boundary (see cross-section B-B′, Figure 2-2).

2.2 INTERMEDIATE SAND AND GRAVEL UNIT RESULTS

The groundwater contour map for the intermediate sand and gravel indicates that the groundwater flow direction in this unit continues to be toward site recovery wells W-1 and W-10 (Figure 2-3). In the northern portion of the site, the calculated horizontal hydraulic gradient was approximately 0.021 ft/ft. In the southeastern portion of the site, the calculated horizontal hydraulic gradient was approximately 0.005 ft/ft.

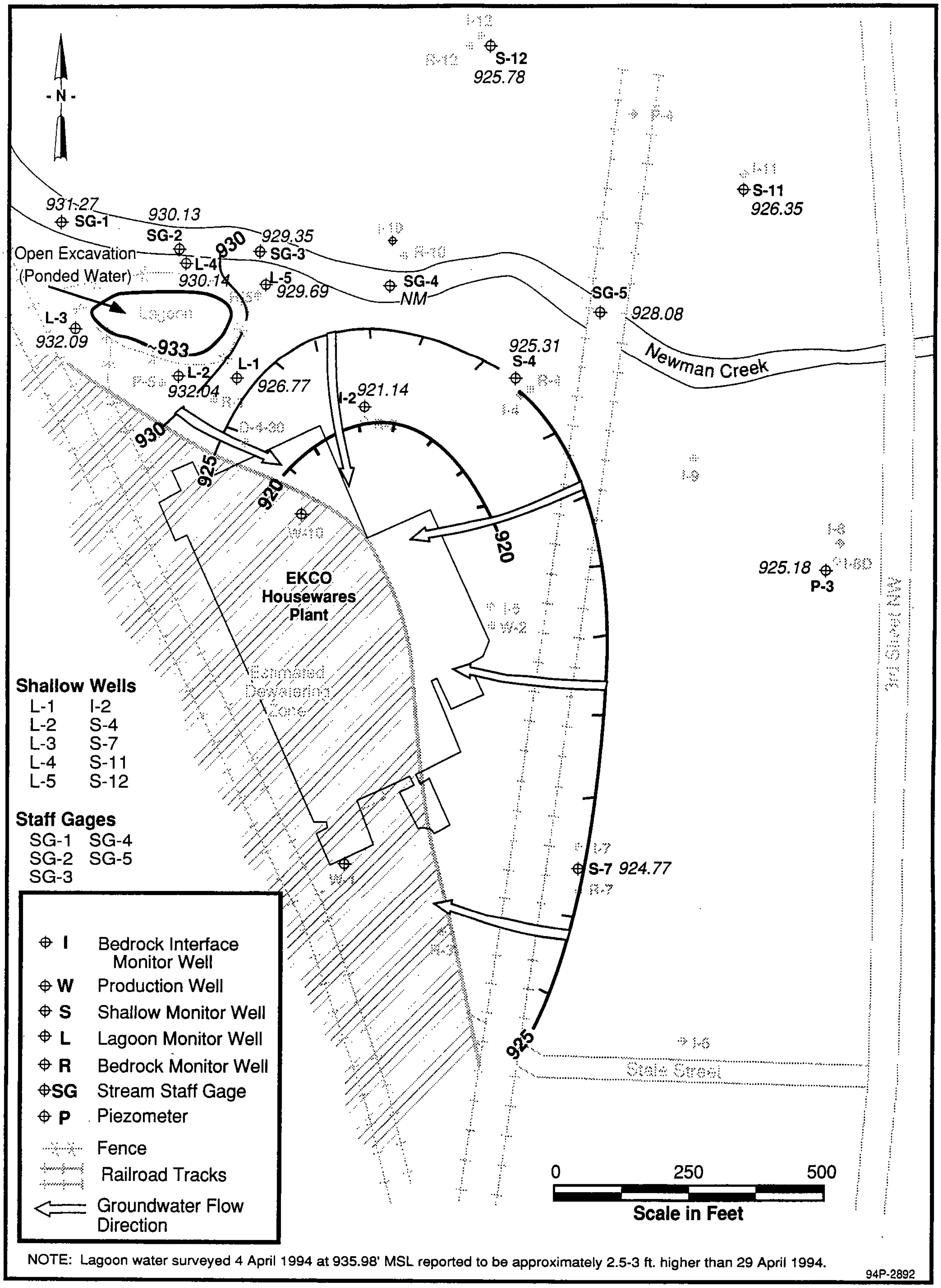

FIGURE 2-1 GROUNDWATER CONTOUR MAP OF WELLS COMPLETED IN THE SHALLOW SAND AND GRAVEL WATER BEARING ZONE – 29 APRIL 1994 EKCO HOUSEWARE FACILITY – MASSILLON, OHIO

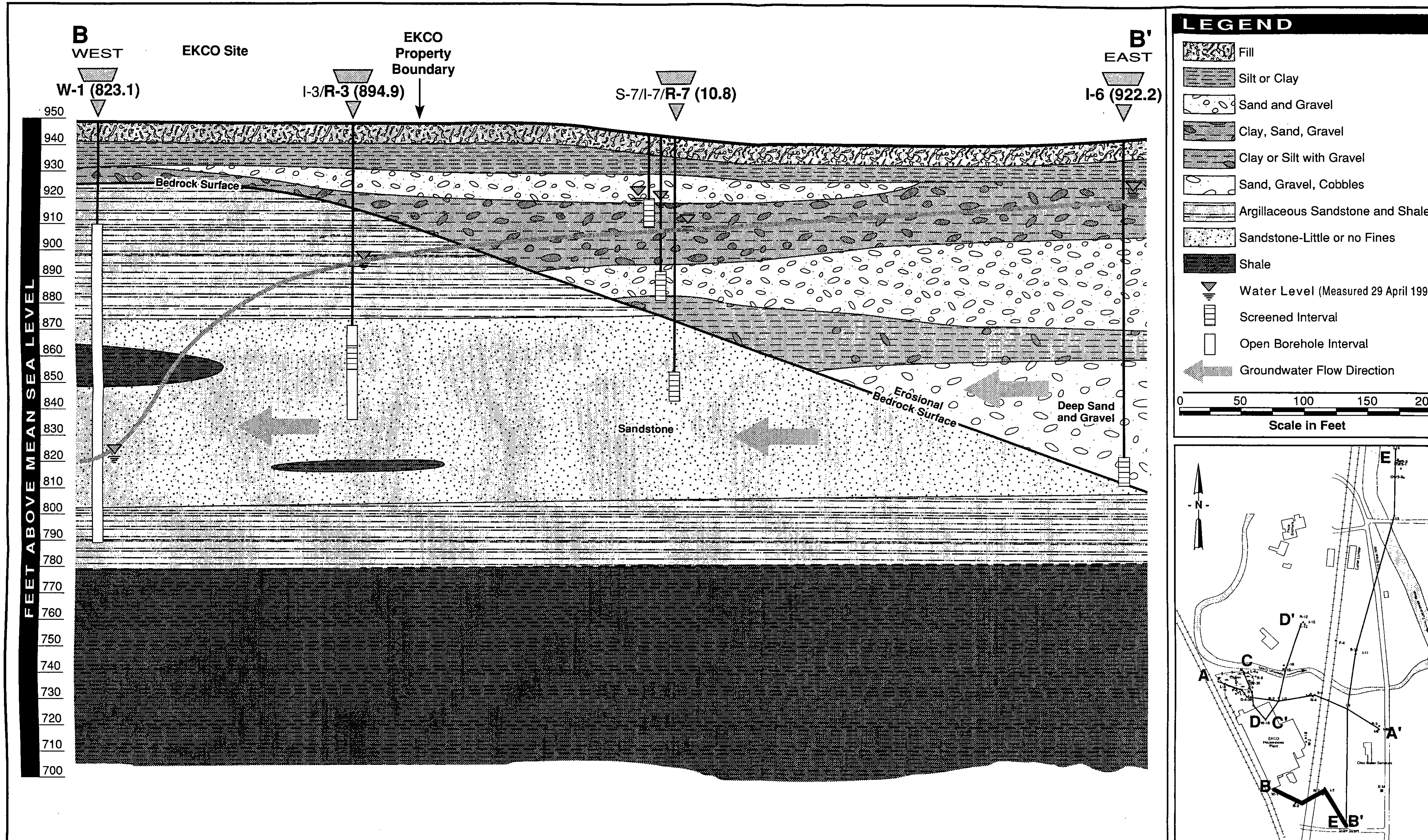

FIGURE 2-2
ANNOTATED GEOLOGIC CROSS SECTION B-B' AT THE EKCO HOUSEWARES PLANT, MASSILLON, OHIO

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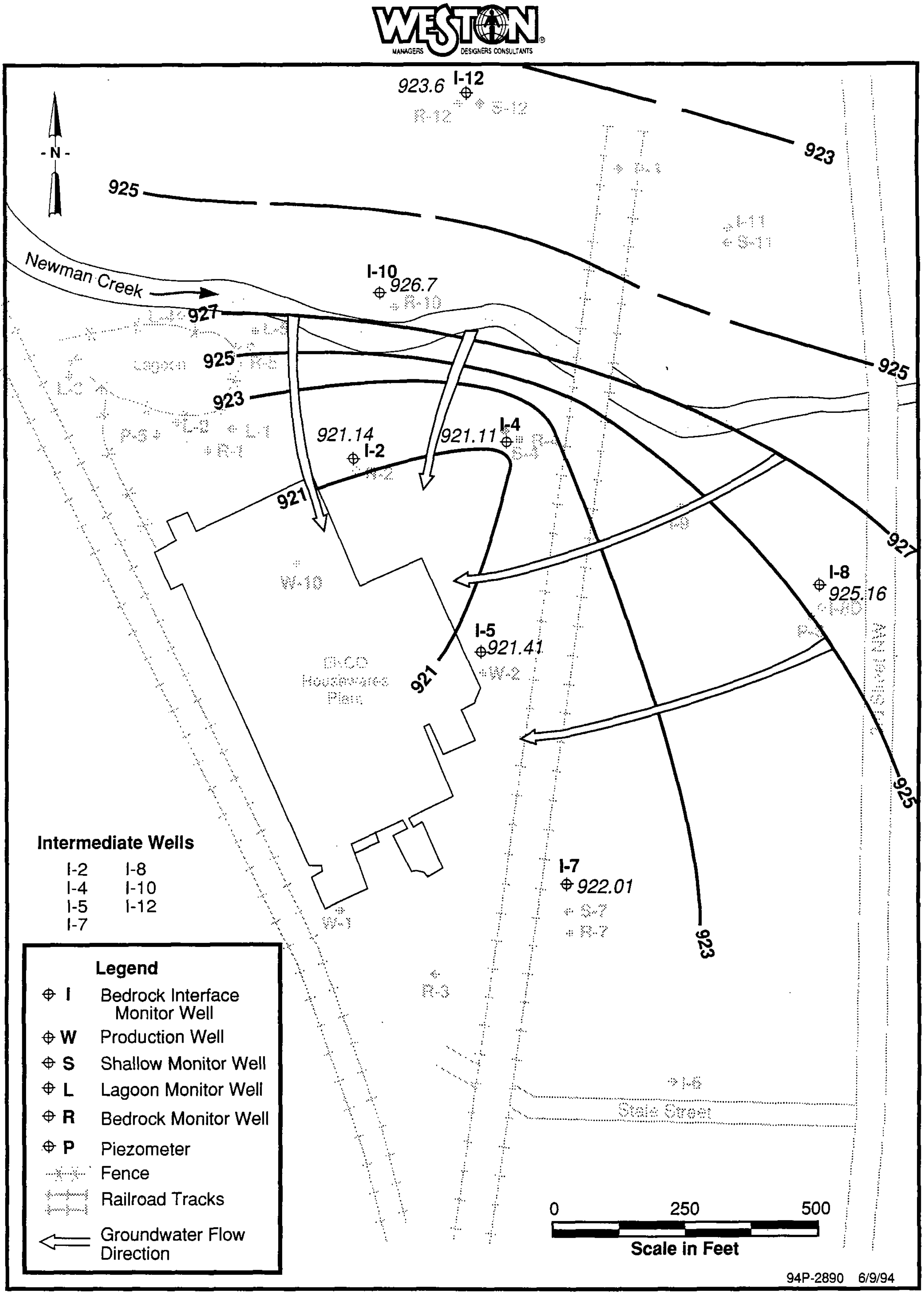

FIGURE 2-3 GROUNDWATER CONTOUR MAP OF WELLS COMPLETED IN THE INTERMEDIATE SAND AND GRAVEL WATER BEARING ZONE, WATER LEVELS MEASURED 29 APRIL 1994 EKCO FACILITY – MASSILLON, OHIO

2.3 BEDROCK UNIT RESULTS

The groundwater contour map for the bedrock indicates that the groundwater flow direction in this unit continues to be toward site recovery wells W-1 and W-10 (Figure 2-3). In the northern portion of the site, the calculated horizontal hydraulic gradients ranged from 0.10 to 0.08 ft/ft toward recovery well W-10. In the southern portion of the site, the calculated horizontal hydraulic gradients were greater, ranging from 0.20 to 0.35 ft/ft toward recovery well W-1. The addition of water level drop-pipes (stillwells) in the recovery wells during liner installations made the collection of accurate pumping water levels more feasible than in the past (especially in well W-1). As shown in Figure 2-4, a large composite cone of depression exists on the potentiometric groundwater surface of the bedrock unit as a result of the combined pumping of wells W-1 and W-10 (257 gpm and 225 gpm, respectively).

Post-rehabilitation monitoring also indicates that the degree of hydraulic separation between the shallow sand and gravel unit and the bedrock unit has been significantly increased as a result of retrofitting the R-wells. A comparison of historical groundwater elevations between shallow well I-2 and bedrock well R-2 indicates that the head differentials between these adjacent wells increased by approximately 22 ft as a result of rehabilitation. Comparison of historical groundwater elevations between shallow well L-1 and bedrock well R-1 indicates that the head differentials between these adjacent wells increased by approximately 14 ft as a result of rehabilitation.

2.4 DEEP SAND AND GRAVEL UNIT RESULTS

The groundwater contour map for the deep sand and gravel unit indicates that in the areas near the sandstone/deep unit contact, groundwater continues to flow west toward the EKCO site as a result of the pumping of recovery wells W-1 and W-10 (Figure 2-5). Farther away from the site, near wells I-11 and I-13, groundwater flow in the deep sand and gravel unit continues to be governed by the OWS wells, which pull groundwater to the north. The calculated horizontal hydraulic gradients toward the site ranged from 0.05 ft/ft in the vicinity of Well I-6, to 0.015 ft/ft in the vicinity of Well I-9.

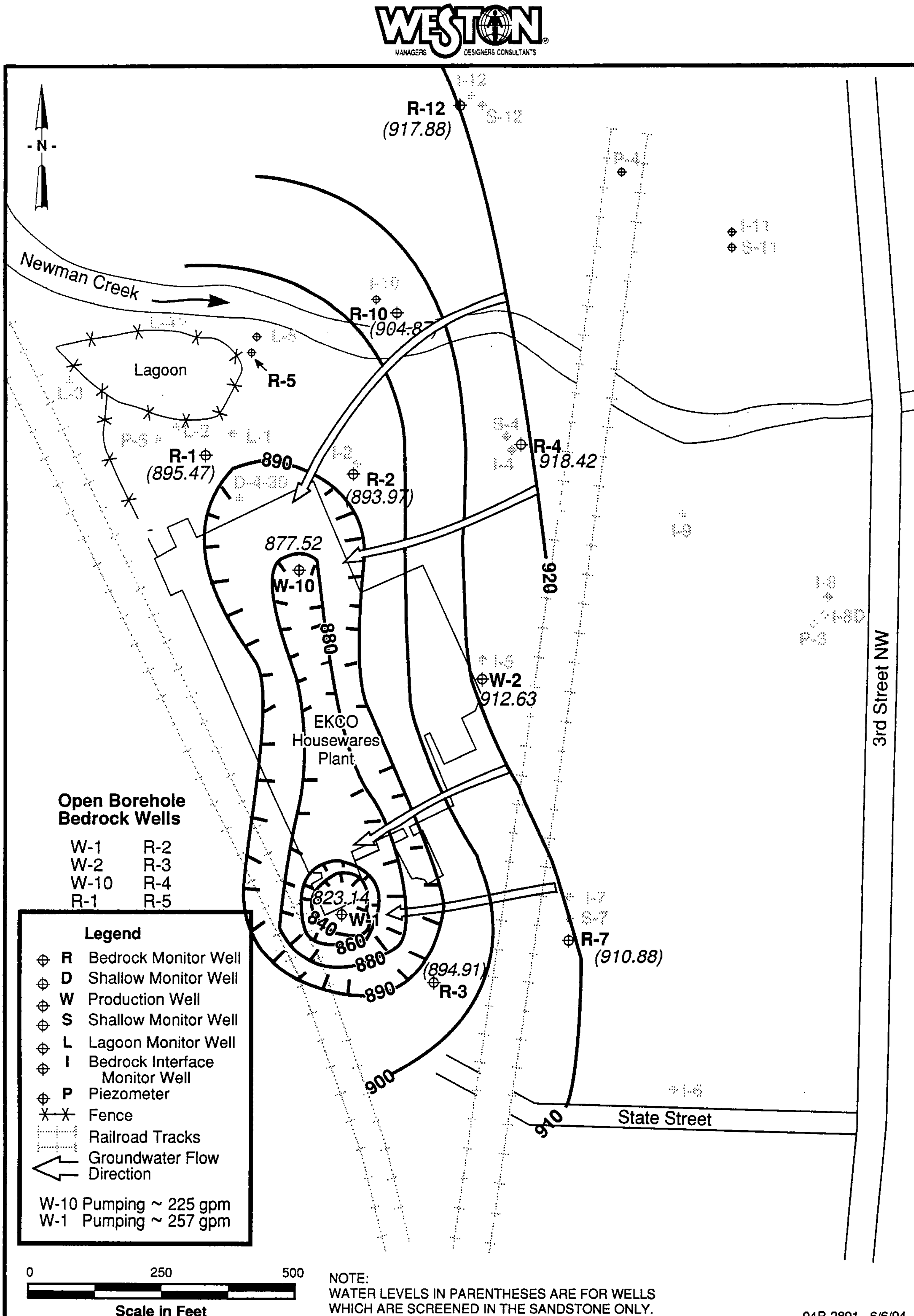

FIGURE 2-4 GROUNDWATER CONTOUR MAP OF WELLS COMPLETED IN THE BEDROCK, 29 APRIL 1994 EKCO HOUSEWARES FACILITY – MASILLON, OHIO

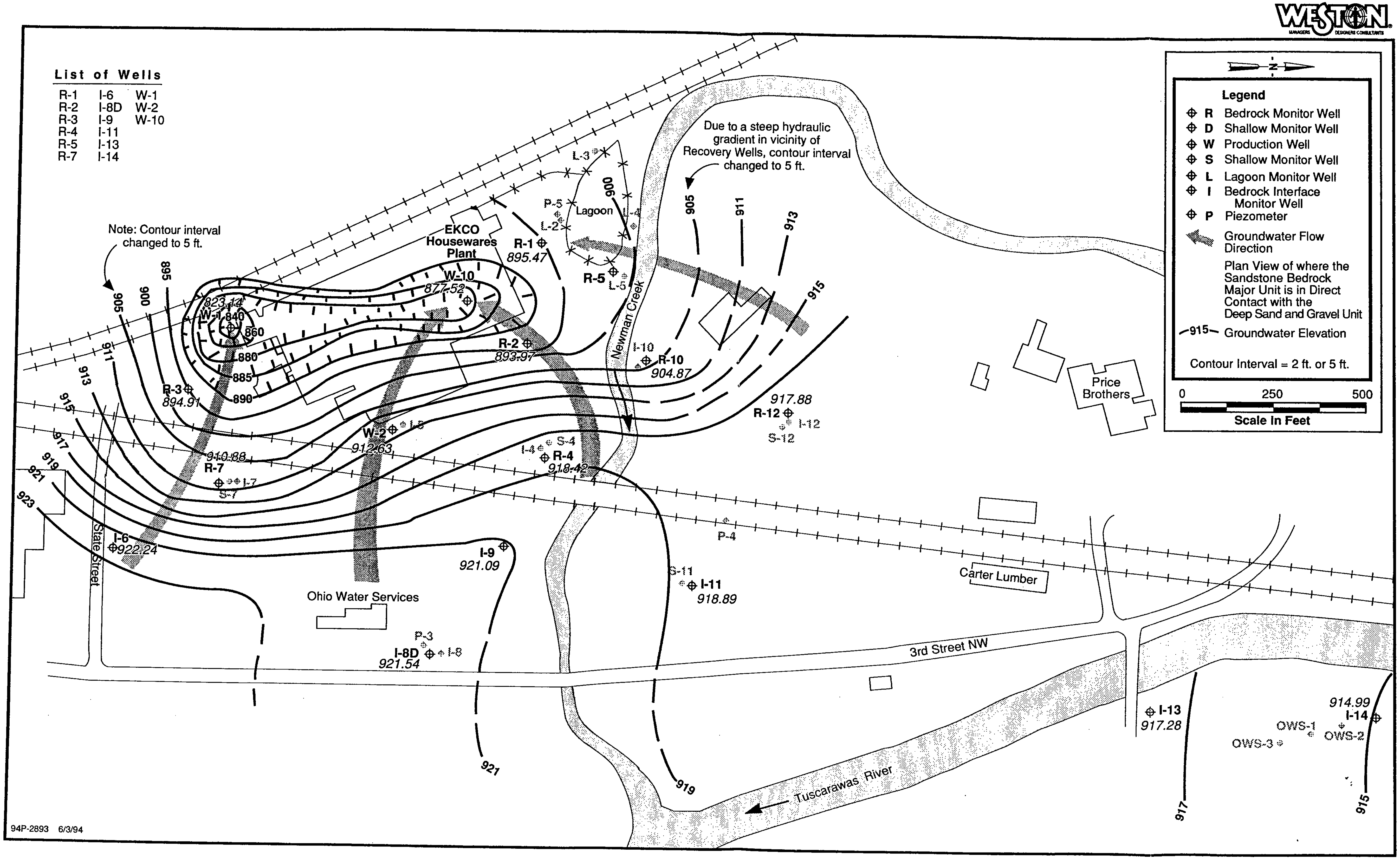

FIGURE 2-5 GROUNDWATER CONTOUR MAP OF WELLS COMPLETED IN THE DEEP SAND AND GRAVEL AND BEDROCK WATER BEARING ZONE–29 APRIL 1994 EKCO FACILITY, MASSILLON, OHIO

2.5 IMPACT OF WELL REHABILITATION INTERIM REMEDIAL MEASURES ON CORRECTIVE MEASURES STUDY RESULTS

It was projected that the well rehabilitation IRM could result in the loss of hydraulic control of the shallow and intermediate water-bearing zones on the EKCO property. As discussed above, based on available data, hydraulic control has been maintained. Two groundwater alternatives presented in the CMS (GW-2 and GW-3) had provisions for installation of shallow and intermediate zone recovery wells to maintain hydraulic control. The results of the IRM have shown that these wells would not be necessary for the purpose of maintaining hydraulic control. In the Draft IRM Report, however, it was recommended that:

> "A more efficient groundwater remediation approach should be considered for the shallow water-bearing zone on-site. The shallow groundwater is the most heavily impacted unit on-site (specifically just north of the plant building). While shallow groundwater does not flow off-site and shallow wells at the property boundary have historically been non-detect for VOCs, the remediation of shallow groundwater in the areas of concern on-site is still warranted."

Based on the results of the well rehabilitation IRM and these recommendations, the groundwater technologies and alternatives have been re-evaluated. These evaluations are presented in the following sections.

SECTION 3

IDENTIFICATION AND SCREENING OF TECHNOLOGIES

3.1 INTRODUCTION

The objective of this CMS Addendum is to identify the most feasible and viable solution for groundwater remediation. The results of the well rehabilitation IRM were used to re-evaluate feasible technologies that are potentially applicable to achieve the corrective measures objectives outlined in Section 2 of the CMS. This section identifies potential technologies and presents the results of the screening of corrective measures technologies to identify viable technologies and eliminate those that are infeasible to implement or do not achieve the corrective measures objectives.

Characteristics used to screen technologies included:

- Site characteristics - Site data gathered during the RFI that identified conditions that could limit or promote the use of specific technologies.
- Affected media characteristics - Identification of affected media characteristics that limit the effectiveness, feasibility, or viability of technologies.
- Technology limitations - These include level of technology development, performance capabilities, capital and operating costs, and maintenance.

Those technologies that are precluded by site characteristics, affected media characteristics, poor reliability, or performance, or those that are economically infeasible compared to others were eliminated in the screening process.

Groundwater corrective measures technologies were previously identified in Section 3 of the CMS and are presented in Table 3-1. The results of the well rehabilitation IRM do not impact the screening results. All technologies that were retained during the CMS will continue to be retained. One additional technology, air sparging, has been added and is presented below.

Table 3-1

General Corrective Actions and Corrective Measures Technologies for Groundwater

General Corrective Actions	Corrective Measure Technology	Process Options	Screening Results (Retained - Yes or No) and Applicability
No Action	None	None	Yes; required by Work Plan. Does not meet objectives.
Institutional Actions	Groundwater Monitoring	—	Yes; used to monitor groundwater levels and concentrations.
	Well Permit Restrictions	—	Yes; used to control future inappropriate use of off-site groundwater.
Collection	Extraction	Pumping wells	Yes; applicable to collection of groundwater at all required depths.
		Interception trenches, ditches, and subsurface drains	No; not applicable to groundwater at the depth necessary.
		Well points	No; not applicable to groundwater at the depth necessary.
Containment	Vertical Barriers	—	Yes; applicable to shallow and intermediate groundwater units.
Treatment	Physical Treatment	Air stripping	Yes; currently used and most widely applied to similar conditions for TCE.
		Activated carbon	Yes; applicable to TCE-contaminated groundwater.

3.2 SCREENING OF ADDITIONAL GROUNDWATER CORRECTIVE MEASURES TECHNOLOGIES - AIR SPARGING

Description - Air sparging is a full-scale technology in which air is injected into a saturated zone, creating an underground stripper that removes contaminants through volatilization. This is accomplished by installing a series of air injection wells within the saturated zone that are connected to an air compressor. Air sparging must be operated in conjunction with an SVE system that would capture VOCs stripped from the saturated zone.

Effectiveness - Air sparging has been successfully applied to VOCs in groundwater. The presence of low permeability layers can impact the effectiveness of air sparging. Heterogeneous soils can result in preferential air flow pathways. These conditions can necessitate additional engineering methods, such as the installation of vents through impermeable zones that can control air flow pathways.

Implementability - Air sparging systems can be readily implemented using conventional drilling techniques. Air sparging of the shallow water-bearing zone could be used at Area 3 in conjunction with the SVE recommended in the CMS. The remaining areas where SVE was recommended (see Figure 1-1) are not suitable for air sparging; the shallow water-bearing zone does not exist in these areas. Pilot-scale testing, which would consist of a limited number of injection wells and monitoring points, is recommended to determine the operating and design parameters for full implementation at the site.

Cost - The cost for this technology is expected to be moderate.

Recommendation - This technology is applicable and will be retained for further consideration.

SECTION 4

REMEDIAL ACTION ALTERNATIVES

4.1 DEVELOPMENT OF REMEDIAL ALTERNATIVES

Remedial action alternatives have been developed for the cleanup of the EKCO facility. These alternatives are based on the technologies retained in the screening process detailed in Section 3 of the CMS and one additional technology presented in Section 3 of this report. Remedial action alternatives for groundwater and soils were previously developed in Section 4 of the CMS. Groundwater alternatives have been revised based on the following well rehabilitation IRM conclusions:

- Hydraulic control of the shallow and intermediate water-bearing zones has been maintained.
- More efficient shallow groundwater recovery should be considered.

The new groundwater alternatives are developed below.

4.2 GROUNDWATER ALTERNATIVES DEVELOPED FOR EVALUATION

Groundwater in the shallow, intermediate, and bedrock water-bearing zones at the EKCO facility is currently contained on-site by the IRM pumping of bedrock wells W-1 and W-10. Based on the findings presented in the CMS and the well rehabilitation IRM, the following groundwater remedial technologies were retained:

- No action.
- Groundwater monitoring.
- Well permit restrictions.
- Pumping wells.
- Air stripping.
- Air sparging.

Two institutional groundwater control methods, groundwater monitoring and well permit restrictions, were retained for further consideration in conjunction with groundwater recovery technologies during the screening process. Groundwater monitoring may consist of two actions: periodic water level measurements to ensure adequate capture of contaminated groundwater, and chemical analysis of groundwater samples to monitor the level of contamination in the groundwater. Restrictions on groundwater use in the vicinity of the facility would be needed to ensure hydraulic control of site groundwater.

During the RFI, following an extended shutdown of recovery well W-1, it was noticed that the level of VOCs in the recovered groundwater increased dramatically in the next sampling event. VOCs at W-1 increased from 256 μg/L prior to the shutdown to 4,726 μg/L following the shutdown. Based on this finding, pulse pumping of the W-wells was considered as a potential remedial approach that could serve to reduce the overall time frame necessary to remediate the groundwater at the facility. The recommended alternative for groundwater (GW-3) in the CMS involved the use of pulse pumping as preferable to constant pumping. Pulse pumping of W-1 and W-10, therefore, will be retained in each alternative that will be evaluated.

In the CMS, granular-activated carbon (GAC) for groundwater treatment was not retained for analysis. The results of the well rehabilitation IRM have not affected the selection of air stripping for groundwater treatment. Each alternative, therefore, will be evaluated based on the use of the existing air stripper for groundwater treatment.

Sample analysis indicate VOC levels in wells W-1 and W-10 have averaged 141 ug/L and 1,800 ug/L, respectively, in 1994. Sampling results of shallow wells in the area north of the building (D-4-30, L-1, and I-2) show total VOCs ranging from 136 ug/L (L-1, May 1994) to 239,000 ug/L (D-4-30, March 1992). Direct recovery or remediation of shallow groundwater should serve to increase the rate of VOC removal from groundwater at the facility.

Two groundwater technologies have been retained for the purpose of enhancing remediation of the more contaminated shallow water-bearing zone in the area north of the plant:

- Pumping wells
- Air sparging

The current IRM pumping of W-1 and W-10 is meeting the groundwater corrective measures objective of continuing to prevent the migration of contamination from the site.

The alternatives developed based on these technologies are discussed below:

- Alternative GW-4: Pulse pumping - Operation of the existing recovery system would be modified so that each of the recovery wells, W-1 and W-10, would be operated on an alternating (pulsed) basis. The average flowrate of the system would be reduced, and higher VOC removal rates are predicted. The object would be to increase the overall mass flow rate (i.e., pounds per year) of VOCs removed. The existing air stripper would be used to treat the recovered groundwater. Groundwater monitoring would be performed on a semi-annual basis. Wells not required for groundwater monitoring would be grouted/sealed.

- Alternative GW-5: Use of overburden recovery wells and pulse pumping of bedrock wells - Additional recovery wells would be used to enhance groundwater recovery in the shallow and intermediate water-bearing zones in the area north of the building. These wells would concentrate removal of groundwater with the highest level of VOCs. Operation of the existing recovery system would be modified so that each of the recovery wells, W-1 and W-10, would be operated on an alternating (pulsed) basis. The average flowrate of the system would be reduced, and higher VOC removal rates are predicted. The object would be to increase the overall mass flow rate (i.e., pounds per year) of VOCs removed. The existing air stripper will be used to treat the recovered groundwater. Groundwater monitoring would be performed on a semi-annual basis. Wells not required for groundwater monitoring would be grouted/sealed.

- Alternative GW-6: Air sparging of overburden and pulse pumping of bedrock wells - An air sparging system would be installed in the vicinity of well D-4-30. Air sparging would be used to remediate the area of highest groundwater contamination. Operation of the existing recovery system would be modified so that each of the recovery wells, W-1 and W-10, would be operated on an alternating (pulsed) basis. The average flowrate of the system would be reduced, and higher VOC removal rates are predicted. The object would be to increase the overall mass flow rate (i.e., pounds per year) of VOCs removed. The existing air stripper will be used to treat the recovered groundwater. Groundwater monitoring would be performed on a semi-annual basis. Wells not required for groundwater monitoring would be grouted/ sealed.

These groundwater alternatives will be evaluated in Section 5.

SECTION 5

DETAILED ANALYSIS OF CORRECTIVE MEASURES ALTERNATIVES

5.1 INTRODUCTION

This section presents the detailed analysis of the corrective measures alternatives developed in Section 4 of the Addendum to address the contaminated groundwater at the EKCO site. Each alternative is analyzed in detail for technical applicability and cost, and it is qualitatively evaluated for environmental, human health, and institutional considerations as detailed in the RFI/CMS Work Plan. The groundwater alternatives described below have been developed in response to the well rehabilitation IRM, as described in Section 2, and are meant to augment the corrective measures alternatives for groundwater presented in the CMS.

5.2 ANALYSIS CRITERIA

Each of the developed alternatives is evaluated based on the following criteria: technical, environmental, human health, institutional, and cost. These criteria are discussed below.

5.2.1 Technical Criteria

The technical evaluation criteria include performance, reliability, implementability, and safety.

Performance will be evaluated based on the effectiveness and useful life of the corrective measure technology as follows:

- Effectiveness will be evaluated in terms of the ability to perform intended functions, such as containment, diversion, removal, destruction, or treatment. The effectiveness of each corrective measure will be determined either through design specifications or by performance evaluation. Any specific waste or site characteristic that could potentially impede effectiveness will be considered. The evaluation will also consider the effectiveness of combinations of technologies.

- Useful life is defined as the length of time the level of effectiveness can be maintained. Corrective measures technologies, with the exception of destruction technologies, may potentially show deteriorating performance with time. Often, deterioration can be slowed through proper system operation and maintenance, but the technology eventually may require replacement. Each corrective measures alternative will be evaluated in terms of the projected service lives of its component technologies, as well as appropriateness of the technologies.

5.2.2 Environmental Criteria

An environmental assessment (EA) of each alternative will focus on the environmental conditions and pathways of contaminant migration actually addressed by the alternative. The EA for each alternative will include an evaluation of the short- and long-term beneficial and adverse effects on environmentally sensitive areas and an analysis of measures to mitigate adverse effects.

5.2.3 Human Health Criteria

Each alternative will be assessed in terms of the extent to which it mitigates short- and long-term potential human exposure to any residual contamination and how it protects human health both during and after implementation of the corrective measure. The assessment will consider the levels and characterizations of contaminants on-site, potential exposure routes, and the potentially affected population. Each alternative will be evaluated to determine the level and the reduction over time of exposure to contaminants. For management of mitigation measures, the relative reduction of impact will be determined by comparing residual levels of each alternative with existing criteria and standards.

5.2.4 Institutional Criteria

Relevant institutional needs or limitations for each alternative will be assessed. Specifically, the effects of federal, state, and local environmental and public health statutes, standards, regulations, final guidance, or ordinances will be considered.

5.2.5 Cost

The estimated cost for each viable corrective measures alternative will be evaluated in comparison to other alternatives that achieve the performance criteria associated with the corrective measures objectives. In considering the cost of the various alternatives, the following categories are evaluated:

- Capital costs — These costs include expenditures for equipment, labor, and materials necessary to construct corrective measure systems. Also included are engineering design, site preparation, construction supervision, quality assurance, and administrative costs.

- Operating and maintenance costs — These are post-construction costs incurred to ensure effective implementation of the alternative. Such costs may include, but are not limited to, operating labor, maintenance materials and labor, monitoring costs (sampling labor, laboratory analyses, and report preparation), periodic disposal of residues, utilities, and administrative, insurance, and licensing costs.

5.3 DETAILED ANALYSIS OF GROUNDWATER ALTERNATIVES

Groundwater alternatives were evaluated based on the corrective measures objectives developed in Subsection 2.4.1 of the CMS. The following additional alternatives were developed:

- GW-4: Pulse pumping of wells W-1 and W-10.

- GW-5: Use of overburden recovery wells and pulse pumping of wells W-1 and W-10.

- GW-6: Air sparging within shallow zone and pulse-pumping of wells W-1 and W-10.

The alternatives are discussed in the following subsections.

5.3.1 Alternative GW-4: Pulse-Pumping of W-1 and W-10

Under this alternative, contaminated groundwater will continue to be recovered using wells W-1 and W-10. Water, however, will not be pumped continuously from W-1 and W-10; rather, these wells will be operated intermittently, or pulsed. Pulse pumping of wells W-1 and W-10 will reduce the volume of water recovered from the bedrock water-bearing zone. It may also serve to increase the concentration of VOCs in the recovered groundwater. Operation of the wells will be phased so that when one W-well is pumped, the other is on standby. The frequency of switching would be determined during a pulse pumping pilot test and followup groundwater modeling. Pumping of these wells will be sufficient to prevent off-site migration of contaminated groundwater.

Alternative GW-4, for the purposes of the CMS, has been analyzed based on the following approach:

- Operation of the air stripper would continue without modification.
- The following parameters will be monitored for the recovery wells:
    - Water level.
    - Pumping rate.
    - Volume treated.
    - VOC concentration.
- Monitoring of the treatment system parameters would continue. The following treatment system parameters will be monitored:
    - Pumping rate.
    - Volume treated.
    - VOC levels in the air stripper discharge.
    - VOC levels at Outfall No. 001.

- Monitoring of VOC levels in selected perimeter wells will continue.

The final component of this alternative is the placement of restrictions on groundwater in the area. This plan would require the cooperation of local property owners, the City of Massillon, and Ohio EPA (OEPA). The proposed groundwater recovery system is expected to be sufficient to contain contaminated groundwater in the shallow, intermediate, and bedrock water-bearing zones under the current off-site pumping conditions. If an adjacent facility were to install a production or recovery well in one of these units, it is possible that such a well could draw contamination from the EKCO facility. The areas requiring well restrictions will be delineated following the pulse pumping test and groundwater modeling efforts.

5.3.1.1 Technical Evaluation

Monitoring will be used to evaluate the groundwater recovery system and to verify its effectiveness in migration control and aquifer restoration. During testing of this alternative, water level measurements would be recorded to ensure that hydraulic control of the bedrock is maintained. Samples would be collected from W-1 and W-10 to monitor the effect of pulse-pumping on VOC levels.

It is expected that periodic maintenance and replacement of the groundwater recovery pumps will be necessary. The air stripper packing may need replacement every 5 years (based on currently available operating data). The recovery wells may need to be rehabilitated every 10 years. The existing groundwater recovery and treatment system has operated reliably since 1986. The modifications proposed in this alternative should not affect the level of reliability of the current system.

5.3.1.2 Environmental Evaluation

This alternative will prevent the off-site migration of contaminated groundwater. VOCs in the recovered groundwater will be treated using the existing permitted air stripper. The treated groundwater will be discharged through Outfall No. 001 in accordance with the facility's National Pollutant Discharge Elimination System (NPDES) permit. No adverse effect to the air or the surface water is expected. The recovery groundwater system will be operated until target levels are reached. At this time, it is not possible to accurately predict the duration that groundwater recovery may be needed. Based on other VOC cleanups using pump and treat technology, however, the projected costs for this alternative (Subsection 5.3.1.5) are figured on a 30-year operating period.

5.3.1.3 Human Health Evaluation

The deep water-bearing zone is currently being used as a source for public drinking water by OWS. OWS currently operates three wells that are located 2,000 ft northeast of the EKCO facility. This alternative will prevent the migration of contamination from the EKCO facility to these wells. The well restriction program will prevent the unauthorized use of groundwater that could draw contamination off-site.

5.3.1.4 Institutional Evaluation

Implementation of the well restriction program to prevent potential off-site migration of VOC-contaminated groundwater will require the cooperation of local property owners, the City of Massillon, and OEPA. The owners of the involved properties may not wish to cooperate.

5.3.1.5 Cost Evaluation

Capital costs for this alternative include preparation of a groundwater model, pulse pump testing, and the implementation of a well restrictions program. Table 5-1 presents estimated order-of-magnitude capital costs for this option. The estimated total capital cost for this option is $86,800. Operating and maintenance costs include labor, utilities, and monitoring

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Table 5-1

Estimated Order-of-Magnitude Capital Costs for Alternative GW-4 (Pulse-Pumping of Wells W-1 and W-10)

Item	Description	Quantity	Unit Cost ($)	Total Cost ($)
1	Groundwater Model Development	Lump Sum	30,000	30,000
2	Pulse Pumping Test	Lump Sum	20,000	20,000
3	Pulse Pumping Controls	1	1,000	1,000
4	Well Restrictions	Lump Sum	8,000	8,000
	Subtotal			59,000
5	Administrative (22%)			13,000
6	Contingency (25%)			14,800
	Total			86,800

of the system performance and the groundwater. Table 5-2 presents the estimated order-of-magnitude operating and maintenance costs for this alternative. The estimated total yearly operating and maintenance costs are $98,300.

5.3.2 Alternative GW-5: Use of Overburden Recovery Wells and Pulse-Pumping of W-1 and W-10

Under this alternative, contaminated bedrock groundwater will be recovered using wells W-1 and W-10, as described in Alternative GW-4 (Subsection 5.3.1).

For this alternative, groundwater will also be recovered from the overlying aquifers. Four new overburden recovery wells will be installed (or existing monitor wells will be converted to recovery wells) for enhanced recovery of the shallow and intermediate water-bearing zones. Location of these recovery wells would be determined using a groundwater flow model. Based on the results of this flow model, the location and pumping rate of recovery wells for the shallow and intermediate water-bearing zones will be finalized.

Alternative GW-5, for the purposes of the CMS, has been analyzed based on the following approach:

- The existing wells, I-2 and L-1, would be converted into recovery wells. Two additional recovery wells would be installed in the area north of the building. These four wells would be connected to the existing air stripper. Each well would be pumped at an approximate rate of 1 gpm. Flow meters would be installed at each well.

- Operation of the air stripper would continue without modification. The flow contribution from the shallow wells would not represent a significant increase.

- The following parameters will be monitored for the six recovery wells:

    - Water level.
    - Pumping rate.
    - Volume treated.
    - VOC concentration.

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Table 5-2

Estimated Order-of-Magnitude Operating and Maintenance Costs for Alternative GW-4 (Pulse-Pumping of Wells W-1 and W-10)

Item	Description	Quantity	Unit Cost ($)	Total Cost/ Year ($)*
1	Labor	Lump Sum	20,000	20,000
2	Analytical	82 Samples	250 $/Sample	20,500
3	Maintenance	Lump Sum	3,400	3,400
4	Utilities	328,500 kw	0.07/kwhr	23,000
	Subtotal			66,900
5	Administrative (22%)			14,700
6	Contingency (25%)			16,700
	Total			98,300

*Years 1 through 30.

- Monitoring of the treatment system parameters would continue. The following treatment system parameters will be monitored:

  - Pumping rate.
  - Volume treated.
  - VOC levels in the air stripper discharge.
  - VOC levels at Outfall No. 001.

- Monitoring of VOC levels in selected perimeter wells will continue.

The final component of this alternative is the placement of restrictions on groundwater in the area. This plan would require the cooperation of local property owners, the City of Massillon, and OEPA. The proposed groundwater recovery system is expected to be sufficient to contain contaminated groundwater in the shallow, intermediate, and bedrock water-bearing zones under the current off-site pumping conditions. If an adjacent facility were to install a production or recovery well in one of these units, it is possible that such a well could draw contamination from the EKCO facility. These areas will be delineated following the pulse pumping test and groundwater modeling efforts.

5.3.2.1 Technical Evaluation

Monitoring will be used to evaluate the groundwater recovery system and to verify its effectiveness in migration control and aquifer restoration. During testing of this alternative, water level measurements would be recorded to ensure that hydraulic control of the bedrock is maintained. Samples would be collected from W-1 and W-10 to monitor the effect of pulse-pumping on VOC levels.

This alternative calls for the conversion of two existing monitoring wells to recovery wells, installation of two new shallow recovery wells, and subsequent connection of these wells to the existing treatment system. It is expected that these shallow wells would be operated at approximately 1 gpm each. The necessary pumps and piping are items that are readily available. Implementation of these changes would require some trenching for the pipe installation. These changes could be readily implemented within a short period of time. OEPA may require minor permit modifications for the additional wells.

It is expected that periodic maintenance and replacement of the groundwater recovery pumps will be necessary. The air stripper packing may need replacement every 5 years (based on currently available operating data). The recovery wells may need to be rehabilitated every 10 years. The existing groundwater recovery and treatment system has operated reliably since 1986. The modifications proposed in this alternative should not affect the level of reliability of the current system.

Workers installing the pumps and the piping would have to wear proper protective clothing to avoid direct contact with VOC-contaminated groundwater and soils. These activities would have no effect on the community.

5.3.2.2 Environmental Evaluation

This alternative will prevent the off-site migration of contaminated groundwater. VOCs in the recovered groundwater will be treated using the existing permitted air stripper. The treated groundwater will be discharged through Outfall No. 001 in accordance with the facility's NPDES permit. No adverse effect to the air or the surface water is expected. The recovery groundwater system will be operated until target levels are reached. At this time, it is not possible to accurately predict the duration that groundwater recovery may be needed.

During the last 12 months of operation, the existing groundwater recovery system has removed on average 10.4 pounds per day of VOCs. Installation of the shallow recovery wells is expected to increase the VOC removal rate by 0.1 to 1 pound per day.

5.3.2.3 Human Health Evaluation

The deep water-bearing zone is currently being used as a source for public drinking water by OWS. OWS currently operates three wells that are located 2,000 ft northeast of the EKCO facility. This alternative will prevent the migration of contamination from the EKCO facility to these wells. The well restriction program will prevent the unauthorized use of groundwater that could draw contamination off-site.

5.3.2.4 Institutional Evaluation

Implementation of the well restriction program to prevent potential off-site migration of VOC-contaminated groundwater will require the cooperation of local property owners, the City of Massillon, and OEPA. The owners of the involved properties may not wish to cooperate.

5.3.2.5 Cost Evaluation

Capital costs for this alternative include preparation of a groundwater model, a pulse pump test, pumps for the additional recovery wells, piping from the wells to the air stripper, and the implementation of a well restrictions program. Table 5-3 presents estimated order-of-magnitude capital costs for this option. The estimated total capital cost for this option is $183,800. Operating and maintenance costs include labor, utilities, and monitoring of the system performance and the groundwater. Table 5-4 presents the estimated order-of-magnitude operating and maintenance costs for this alternative. The estimated total yearly operating and maintenance costs are $129,200.

5.3.3 Alternative GW-6: Air Sparging of Shallow Zone and Pulse-Pumping of W-1 and W-10

Under this alternative, contaminated groundwater will be recovered using wells W-1 and W-10 as discussed in Alternative GW-4 (Subsection 5.3.1).

For this alternative, air sparging will be implemented in conjunction with soil remediation alternative OS-3, vertical SVE (see Subsection 5.4.2.3 of the CMS), in Area 3 north of the building. The location of this area is shown in Figure 5-1.

Table 5-3

Estimated Order-of-Magnitude Capital Costs for Alternative GW-5 (Use of Overburden Recovery Wells and Pulse-Pumping of Wells W-1 and W-10)

Item	Description	Quantity	Unit Cost ($)	Total Cost ($)
1	Groundwater Model Development	Lump Sum	35,000	35,000
2	Installation of Recovery Wells	2	3,500	7,000
3	Well Pumps and Controls	4	3,000	12,000
4	Pulse Pumping Test	Lump Sum	20,000	20,000
5	New Recovery Well Pumping Tests	Lump Sum	20,000	20,000
6	Installation of Piping and Conduit	1,000 ft	20/ft	20,000
7	Tie into Existing System	4	500	2,000
8	Pulse Pumping Controls	1	1,000	1,000
9	Well Restrictions	Lump Sum	8,000	8,000
	Subtotal			125,000
10	Administrative (22%)			27,500
11	Contingency (25%)			31,300
	Total			183,800

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Table 5-4

Estimated Order-of-Magnitude Operating and Maintenance Costs for Alternative GW-5 (Use of Overburden Recovery Wells and Pulse-Pumping of Wells W-1 and W-10)

Item	Description	Quantity	Unit Cost ($)	Total Cost/ Year ($)*
1	Labor	Lump Sum	27,000	27,000
2	Analytical	130 Samples	250 $/Sample	32,500
3	Maintenance	Lump Sum	4,400	4,400
4	Utilities	337,300 kwhr	0.07/kwhr	24,000
	Subtotal			87,900
5	Administrative (22%)			19,300
6	Contingency (25%)			22,000
	Total			129,200

*Years 1 through 30.

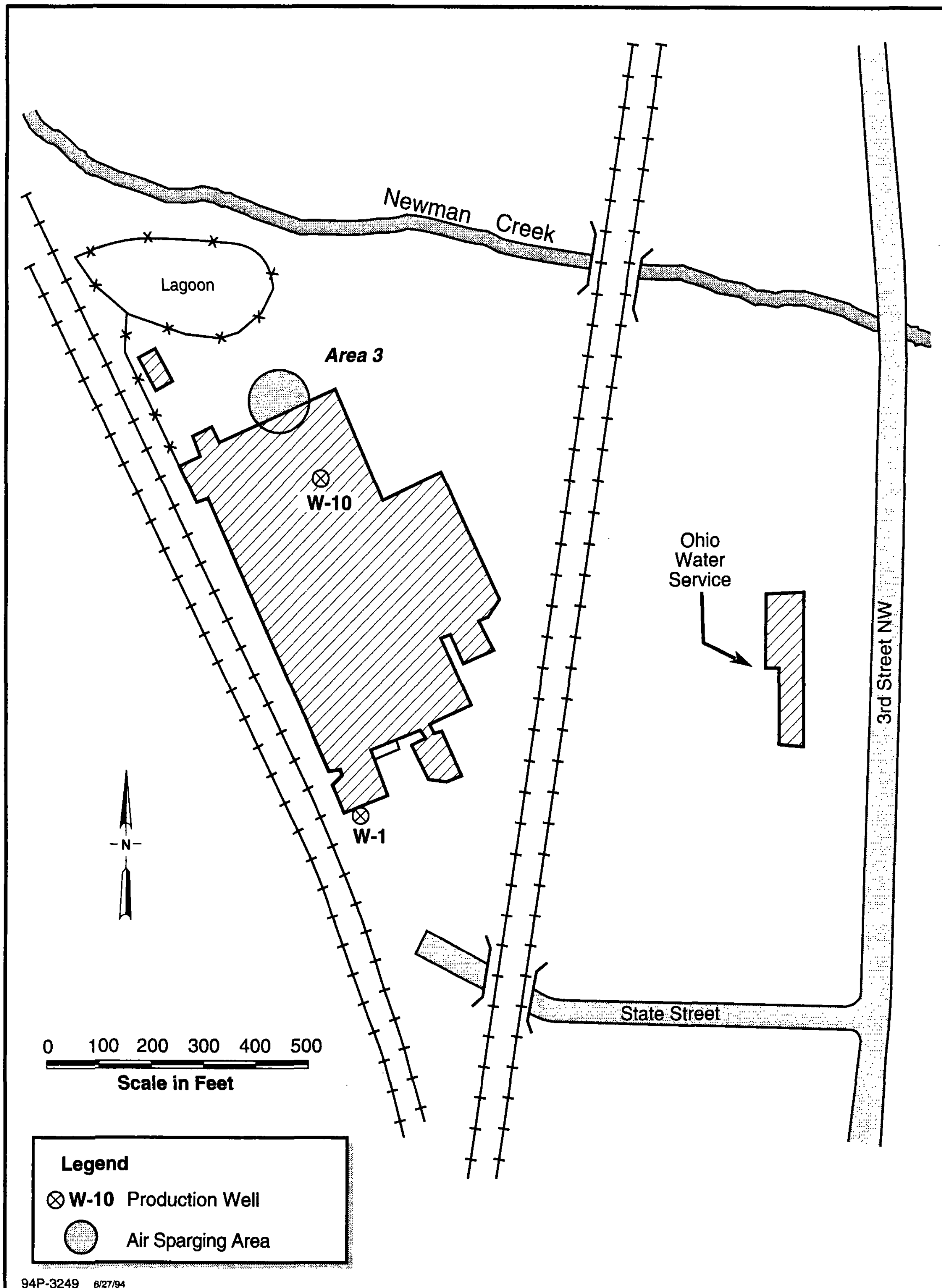

FIGURE 5-1 AIR SPARGING AREA

Air sparging is a technology that mechanically introduces air below the water table, using an air compressor to feed a series of injection wells. VOCs that are dissolved in the groundwater volatilize into the air as the air bubbles move through the groundwater. The VOC-laden air stream is then collected from the vadose zone using a SVE system. The major considerations in applying the technology are contaminant volatility, groundwater flow rate, aquifer permeability, the presence of low permeability layers, vadose zone gas permeability, and the desired cleanup level. These considerations affect the time of cleanup, the number of injection wells, the air flow rate, and need for vents through low permeability layers.

In order to implement this system, a pilot system would be operated for 1 month in conjunction with the pilot SVE described in Subsection 5.4.2.3 of the CMS. The purpose of this phase would be to confirm the effectiveness of air sparging and to determine the final design of the full scale system. This system would consist of one injection well, two monitoring wells, and six pressure monitoring locations. The injection well would be installed to a depth of approximately 33 ft below ground surface.

The dimensions of the area to be treated using air sparging are dependent on the final extent of the proposed SVE for Area 3. Based on current site information, it is projected that 13 air injection wells would be installed. Each injection well would be installed to a depth of 30 to 35 ft with a screened interval of 1 to 2 ft. One air compressor would be operated to supply 3 to 4 standard cubic feet per minute (scfm) of air to each injection well. Installation of the full scale system is expected to take 2 weeks.

Following installation of the system, a 1-to-3 week period will be required for startup of the system. The purpose of the startup operation will be to calibrate and optimize controls and to adjust air injection and vacuum extraction rates. Performance monitoring of the system will be conducted at this time.

Monthly monitoring of the system will be performed in conjunction with monitoring activities of the SVE after the startup period. Each extraction vent would be monitored for the following parameters:

- Flow rate
- Temperature
- VOC levels

The total flow rate and temperature of the feed air from the air injection system would also be monitored. Results from the monthly monitoring would be used to evaluate the effectiveness of the remediation and to determine the need for operational modifications. System maintenance would be performed during these monthly visits.

Alternative GW-6, for the purposes of the CMS, has been analyzed based on the following approach:

- Operation of the air stripper would continue without modification.

- The following parameters will be monitored for the five recovery wells:

    - Water level.
    - Pumping rate.
    - Volume treated.

- Monitoring of the treatment system parameters would continue. In addition, the following treatment system parameters will be monitored:

    - Pumping rate.
    - Volume treated.
    - VOC levels in the air stripper discharge.
    - VOC levels at Outfall No. 001.

- Monitoring of VOC levels in selected perimeter wells will continue.

- Air sparging will be performed for 2 years.

The final component of this alternative is the placement of restrictions on groundwater in the area. This plan would require the cooperation of local property owners, the City of

Massillon, and OEPA. The proposed groundwater recovery system is expected to be sufficient to contain contaminated groundwater in the shallow, intermediate, and bedrock water-bearing zones under the current off-site pumping conditions. If an adjacent facility were to install a production or recovery well in one of these units, it is possible that such a well could draw contamination from the EKCO facility. These areas will be delineated following the well rehabilitation IRM.

5.3.3.1 Technical Evaluation

Monitoring will be used to evaluate the groundwater recovery and air sparging systems and to verify their effectiveness in migration control and aquifer restoration. During the pulse pumping test, water level measurements would be recorded to ensure that hydraulic control of the groundwater is maintained. Samples would be collected from W-1 and W-10 to monitor the effect of pulse-pumping on VOC levels. Groundwater samples will be collected to determine the effectiveness of air sparging in remediating the shallow zone.

It is expected that periodic maintenance and replacement of the groundwater recovery pumps will be necessary. The air stripper packing may need replacement every 5 years (based on currently available operating data). The recovery wells may need to be refurbished every 10 years. The existing groundwater recovery and treatment system has operated reliably since 1986. The modifications proposed in this alternative should not affect the level of reliability of the current system. It is not expected that the air sparging system would be operated for a sufficient duration to require replacement of equipment.

Workers installing the air sparging system would have to wear proper protective clothing to avoid direct contact with VOC-contaminated groundwater and soils. These activities would have no effect on the community.

5.3.3.2 Environmental Evaluation

This alternative will prevent the off-site migration of contaminated groundwater. VOCs in the recovered groundwater will be treated using the existing permitted air stripper. The treated groundwater will be discharged through Outfall No. 001 in accordance with the facility's NPDES permit. No adverse effect to the air or the surface water is expected. The groundwater recovery system will be operated until target levels are reached. The air sparging system will be operated in conjunction with a SVE system to control any vapor emissions. At this time, it is not possible to accurately predict the duration that groundwater recovery may be needed. The air sparging system is expected to operate for 2 years.

5.3.3.3 Human Health Evaluation

The deep water-bearing zone is currently being used as a source for public drinking water by OWS. OWS currently operates three wells that are located 2,000 ft northeast of the EKCO facility. This alternative will prevent the migration of contamination from the EKCO facility to these wells. The well restriction program will prevent the unauthorized use of groundwater that could draw contamination off-site.

5.3.3.4 Institutional Evaluation

Implementation of the well restriction program to prevent potential off-site migration of VOC-contaminated groundwater will require the cooperation of local property owners, the City of Massillon, and OEPA. The owners of the involved properties may not wish to cooperate.

5.3.3.5 Cost Evaluation

Capital costs for this alternative include preparation of a groundwater model, a pulse pump test, an air sparging pilot test and full-scale installation, and the implementation of a well restrictions program. Table 5-5 presents estimated order-of-magnitude capital costs for this

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Table 5-5

Estimated Order-of-Magnitude Capital Costs for Alternative GW-6 (Use of Air Sparging and Pulse-Pumping of Wells W-1 and W-10)

Item	Description	Quantity	Unit Cost ($)	Total Cost ($)
1	Groundwater Model Development	Lump Sum	35,000	35,000
2	Pulse Pumping Controls	Lump Sum	1,000	1,000
3	Pulse Pumping Test	Lump Sum	20,000	20,000
4	Air Sparging Pilot Test	Lump Sum	20,000	20,000
5	Installation of Full Scale Air Sparging System	Lump Sum	76,000	76,000
6	Well Restrictions	Lump Sum	8,000	8,000
	Subtotal			160,000
7	Administrative (22%)			35,200
8	Contingency (25%)			40,000
	Total			235,200

option. The estimated total capital cost for this option is $235,200. Operating and maintenance costs include labor, utilities, and monitoring of the system performance and the groundwater. Table 5-6 presents the estimated order-of-magnitude operating and maintenance costs for this alternative. The estimated total yearly operating and maintenance costs are $185,200 for the first 2 years. Following completion of air sparging activities, these costs are expected to drop to $98,300 annually.

Table 5-6

Estimated Order-of-Magnitude Operating and Maintenance Costs for Alternative GW-6 (Use of Air Sparging and Pulse-Pumping of Wells W-1 and W-10)

Item	Description	Quantity	Unit Cost ($)	Total Cost/ Year ($)*
1	Labor	Lump Sum	50,000	50,000
2	Analytical	178 Samples	250 $/Sample	44,500
3	Maintenance	Lump Sum	6,400	6,400
4	Utilities	358,500	.07/kwhr	25,100
	Subtotal			126,000
5	Administrative (22%)			27,700
6	Contingency (25%)			31,500
	Total			185,200

*Years 1 through 2.

Note — In years 3 through 30, yearly operation and maintenance costs are projected to drop to $98,300 annually.

SECTION 6

RECOMMENDATION OF CORRECTIVE MEASURES ALTERNATIVES

6.1 SUMMARY AND COMPARISON OF ALTERNATIVES

This CMS Addendum has been performed in compliance with the RFI/CMS Work Plan and applicable guidance. Groundwater alternatives were modified based on the well rehabilitation IRM presented in Section 2. In Section 3, technologies were identified and screened. Additional corrective measures alternatives for groundwater were developed based on site-specific conditions in Section 4 of the CMS Addendum. These corrective measures alternatives were then analyzed in detail in Section 5. In this section, the alternatives that were developed in the CMS and the CMS Addendum are summarized and compared. Based on this comparison, a recommendation of the specific corrective measures alternatives is presented and reflects technical, environmental, and human health criteria.

6.1.1 Summary and Comparison of Groundwater Alternatives

The following groundwater corrective measures alternatives were evaluated:

- GW-1 - No action.
- GW-2 - Installation of additional overburden recovery wells and constant pumping of wells W-1 and W-10.
- GW-3 - Installation of additional overburden recovery wells and pulse pumping of wells W-1 and W-10.
- GW-4 - Pulse pumping of wells W-1 and W-10 only.
- GW-5 - Installation of overburden recovery wells and pulse pumping of wells W-1 and W-10.
- GW-6 - Air sparging of overburden and pulse pumping of wells W-1 and W-10.

These alternatives are summarized in Table 6-1.

Table 6-1

Summary and Comparison of Corrective Measures Alternatives for Groundwater

Alternative	Technical	Environmental	Human Health
GW-1: No Action	Readily implemented. Current groundwater recovery operation would cease.	Off-site migration of VOC contamination would occur. VOCs may migrate to Newman Creek.	Potential impacts to OWS wells would not be prevented.
GW-2: Installation of Additional Overburden Recovery Wells and Constant Pumping of Wells W-1 and W-10.	Readily implemented. Long-term monitoring of system is necessary. Restrictions on adjacent well pumping would be required.	Will prevent off-site migration of VOC- contaminated groundwater. VOCs will be emitted to atmosphere under permit. Treated groundwater would be discharged to Newman Creek.	Will prevent potential impacts to OWS wells and unauthorized use of groundwater.
GW-3: Installation of Additional Overburden Recovery Wells and Pulse Pumping of Wells W-1 and W-10	Readily implemented. Test of pulse pumping options necessary. Long-term monitoring of system is necessary. Remediation process should be accelerated. Restrictions on adjacent well pumping would be required.	Will prevent off-site migration of VOC contamination. VOCs will be emitted to atmosphere under permit. Treated groundwater would be discharged to Newman Creek.	Will prevent potential impacts to OWS wells and unauthorized use of groundwater.
GW-4: Pulse pumping of wells W-1 and W-10	Readily implemented. Test of pulse pumping options necessary. Long-term monitoring of system is necessary. Remediation process should be accelerated. Restrictions on adjacent well pumping would be required.	Will prevent off-site migration of VOC contamination. VOCs will be emitted to atmosphere under permit. Treated groundwater would be discharged to Newman Creek.	Will prevent potential impacts to OWS wells and unauthorized use of groundwater.

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Table 6-1

Summary and Comparison of Corrective Measures Alternatives for Groundwater (Continued)

Alternative	Technical	Environmental	Human Health
GW-5: Installation of Overburden Recovery Wells and Pulse Pumping of Wells W-1 and W-10.	Readily implemented. Test of pulse pumping options necessary. Long-term monitoring of system is necessary. Remediation process should be accelerated. Will enhance remediation of shallow and intermediate zone contamination. Restrictions on adjacent well pumping would be required.	Will prevent off-site migration of VOC- contaminated groundwater. VOCs will be emitted to atmosphere under permit. Treated groundwater would be discharged to Newman Creek.	Will prevent potential impacts to OWS wells and unauthorized use of groundwater.
GW-6: Air Sparging of Overburden and Pulse Pumping of Wells W-1 and W-10	Requires installation of SVE in conjunction with air sparging system and pilot testing. Test of pulse pumping options necessary. Long-term monitoring of system is necessary. Remediation process should be accelerated. Will enhance shallow zone remediation. Restrictions on adjacent well pumping would be required.	Will prevent off-site migration of VOC-contaminated groundwater. VOCs will be emitted to atmosphere under permit. Treated groundwater would be discharged to Newman Creek.	Will prevent potential impacts to OWS wells and unauthorized use of groundwater.

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6.1.2 Summary of Costs for Each Alternative

A summary of the estimated order-of-magnitude capital and operating and maintenance costs for each alternative is presented in Table 6-2. Operating and maintenance costs for each alternative are presented on a present-worth basis, assuming a term of 30 years at an interest rate of 6%. For GW-6, it is assumed that air sparging will be performed for 2 years and wells W-1 and W-10 will be operated for 30 years.

6.2 RECOMMENDED CORRECTIVE MEASURES ALTERNATIVES

In Subsection 2.4.1 of the CMS, the following corrective measures objectives for groundwater were proposed:

- Achieve regulatory standards (MCLs) for organics found in all on-site aquifers.
- Continue the prevention of migration of contamination from the site.
- Achieve regulatory standards (MCLs) for organics found in any portion of the deep sand and gravel layer (which serves the OWS wells), which is adjacent to the site and has been impacted by it.

Six alternatives for groundwater were developed for detailed analysis. Alternative GW-1 (no action) does not meet the corrective measures objectives for groundwater. Alternatives GW-2 (installation of additional recovery wells and constant pumping of wells W-1 and W-10) and GW-3 (installation of additional recovery wells and pulse pumping of wells W-1 and W-10) were developed given the assumption that additional recovery wells were necessary to maintain hydraulic control of the shallow and intermediate water-bearing zones following well rehabilitation IRM activities. As discussed in Section 2 of this Addendum, hydraulic control has been maintained. Alternatives GW-2 and GW-3 would both directly remediate shallow zone contamination.

Table 6-2

Summary of Estimated Order-of-Magnitude Capital and Operating and Maintenance Costs

Alternative	Capital Cost ($)	Present Worth of Operating and Maintenance Cost ($)	Total Present-Worth Cost ($)
GW-1: No Action	0	0	0
GW-2: Use of additional overburden recovery wells and constant pumping of wells W-1 and W-10	107,000	1,962,500*	2,069,500
GW-3: Use of additional overburden recovery wells and pulse pumping of wells W-1 and W-10	181,000	1,800,500*	1,981,500
GW-4: Pulse pumping of wells W-1 and W-10	86,800	1,434,300*	1,521,100
GW-5: Use of overburden recovery wells and pulse pumping of wells W-1 and W-10	183,800	1,885,100*	2,068,900
GW-6: Air sparging and pulse pumping of wells W-1 and W-10	235,200	1,603,100*	1,838,300

*Based on a 30-year present-worth determination; interest = 6%.

Alternatives GW-2, GW-3, GW-4, GW-5, and GW-6 meet the corrective measures objectives in functionally the same manner. Each would control the shallow, intermediate, and bedrock water-bearing zones using recovery wells W-1 and W-10. Alternatives GW-3, GW-4, GW-5, and GW-6 refine this approach by incorporating pulse pumping of the bedrock recovery wells. The existing data suggest that pulse pumping may serve to increase the level of VOCs in the recovered groundwater. This in turn may lead to a reduction in the time required to reduce site groundwater to regulatory standards. Alternative GW-2, therefore, is not recommended.

Alternative GW-4 will only indirectly result in remediation of the shallow zone. Alternatives GW-3, GW-5, and GW-6 will result in enhanced VOC removal rates from the shallow water-bearing zone. Alternatives GW-3 and GW-5 both rely on recovery wells to reduce VOC levels in the shallow water-bearing zone. Alternative GW-5 will address shallow groundwater contamination more aggressively; however, a preliminary analysis of shallow zone contaminant data indicates that the additional amount of VOCs removed would be less than 1 pound per day. With Alternative GW-6, air sparging would be used to reduce VOC levels in the shallow water-bearing zone. Alternative GW-6 requires that soils alternative OS-3 (SVE operation) be selected. It is projected that Alternative GW-6 will result in the largest increase in VOC recovery rates; however, this will be determined during a pilot test. Based these considerations, Alternative GW-6 is recommended. Should the pilot test indicate that air sparging would not be effective, Alternative GW-5 would be recommended.

FINAL

CORRECTIVE MEASURES STUDY
EKCO HOUSEWARES, INC.
MASSILLON, OHIO

NOVEMBER 1993

Nov. 26th

PREPARED FOR

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SECTION 1

DESCRIPTION OF CURRENT SITUATION

1.1 PROJECT OVERVIEW

1.1.1 Background

Roy F. Weston, Inc. (WESTON®) was contracted in 1991 to conduct a Resource Conservation and Recovery Act (RCRA) Facility Investigation/Corrective Measures Study (RFI/CMS) for the EKCO Housewares, Inc. (EKCO) facility located in Massillon, Ohio. This work is being performed in accordance with an Administrative Order on Consent (Consent Order), signed between EKCO, Inc. and the U.S. Environmental Protection Agency (EPA) in March/April 1989.

The Draft RFI Report was submitted to EPA in August 1992. EPA comments were subsequently received in April 1993. A Final RFI Report and written responses to EPA comments were submitted in May 1993. Additional EPA comments were received in July 1993. Revised pages of the Final RFI Report, as well as responses to these comments, were submitted to the EPA on 10 August 1993. Most recently, a letter dated 3 November 1993 was received from EPA indicating agency approval of the RFI with modifications (attached to the letter).

The Draft CMS Report was initiated shortly thereafter and submitted to EPA on 30 September 1993. EPA comments on the Draft CMS Report, dated 21 October 1993, have been received.

The revised CMS report presented herein incorporates the EPA comments presented in the 21 October 1993 letter, changes which EPA states in its comment letter are required to be made in accordance with the Consent Order. However, EKCO does not agree with many of the comments and changes proposed by EPA. Nevertheless, these required changes have been incorporated into this report not because EKCO agrees that they are warranted, but only because EKCO has been ordered to do so by EPA. These revisions are submitted on the express understanding that EKCO does not agree with them. EKCO's position is that these changes ordered by EPA will have no impact upon the recommendations for remediation previously presented. Formal responses to these EPA comments, which indicate the comments EKCO disagrees with and a summary of the reasons for the disagreement, are presented in Appendix A of this document.

EKCO does not wish to invoke the dispute resolution provisions of the Consent Order at this time because of its concern that delays to the selection and implementation of a remedy at the site would occur.

1.1.2 CMS Objectives

The objectives of the CMS are to develop and evaluate potential corrective measures, and to recommend the corrective measure(s), if any, to be implemented. The CMS has been performed based on the requirements presented in the RFI/CMS Work Plan approved by EPA (WESTON, 1990).

1.1.3 RFI/CMS Scope of Work

The RFI/CMS Scope of Work consists of 11 tasks:

- Task I: Description of Current Conditions
- Task II: Pre-Investigation Evaluation of Corrective Measures Technology
- Task III: RFI Workplan Requirements
- Task IV: RCRA Facility Investigation
- Task V: Investigation Data Analysis
- Task VI: RCRA Facility Investigation Report
- Task VII: Identification and Development of the Corrective Measure Alternative(s)

- Task VIII: Laboratory and Bench Scale Studies

- Task IX: Evaluation of the Corrective Measure Alternative(s)

- Task X: Recommendation of the Corrective Measure or Measures

- Task XI: CMS Report

Tasks I, II, and III were presented in the RFI/CMS Work Plan (WESTON, May 1990). Tasks IV, V, and VI formed the basis of the RFI program at the EKCO facility. The CMS consists of the remaining five tasks. In Task VII, WESTON will identify, screen, and develop alternative(s) for removal, containment, treatment, and/or other remediation of the contamination based on the objectives established for the corrective measure. Task VII includes the following requirements:

- Description of current situation.
- Establishment of corrective measure objectives.
- Screening of corrective measures technologies.
- Identification of the corrective measure alternative(s).

No laboratory or bench-scale studies are required during Task VIII. In Task IX, each corrective measure alternative retained following the initial screening in Task VII will be evaluated. The evaluation is based on technical, environmental, human health, and institutional concerns. Cost estimates will be developed for each alternative. In Task X, WESTON will recommend a corrective measure alternative based on technical, environmental, and human health criteria. The requirements of the CMS report are contained in Task XI. The CMS report will present the results of Tasks VII, VIII, IX, and X including:

- Description of the facility, including a site topographic map and preliminary layouts.

- Summary of the RFI and relevant information used to evaluate and select corrective measures.

- Description of the corrective measure alternative evaluation process and results of the following:

- Development of the corrective measures objectives.
- Description of the possible corrective measure(s) and discussion of:
  - Performance expectations.
  - Preliminary design criteria and rationale.
  - General operation and maintenance requirements.
  - Long-term monitoring requirements.
- Identification and development of the corrective measure alternatives.
- Evaluation of the corrective measure alternatives.
- Design and implementation requirements:
  - Technical concerns.
  - Additional engineering data required.
  - Permits and regulatory requirements.
  - Access, easements, right-of-way.
  - Health and safety requirements.
  - Community relations issues.

- Recommendation of a corrective measure alternative, including the following:
  - Comparison with corrective measure objectives.
  - Justification of selection.
  - Beneficial aspects of the selected corrective measures alternative.
  - Limitations of the selected corrective measures alternative.

1.2 SITE BACKGROUND

1.2.1 Site Location

The EKCO facility occupies approximately 13 acres in the town of Massillon, Stark County, Ohio (Figure 1-1). The area surrounding the site is largely urban and industrial. Land use to the northwest is more rural with a larger proportion of open space. The EKCO property is triangular in shape and lies an estimated 1,500 ft west of the Tuscarawas River. The facility is bordered to the north by Newman Creek, while Conrail and the Baltimore and Ohio railroads border the EKCO property to the west and east, respectively. The Baltimore and Ohio Railroad has numerous spurs and sidetracks adjacent to the EKCO plant that are used for the storage of rail cars and track maintenance vehicles.

A variety of businesses are located adjacent to the EKCO plant. These include Ohio Packaging (paper) to the south, sand and gravel quarries to the west and northwest, Carter Lumber (retail) and American Drain Pipe (concrete pipe manufacturing) to the north, and the Ohio Water Service (public water supply) waterworks to the east. An inactive municipal landfill exists just east of the Ohio Water Service facility.

1.2.2 Site History

A summary of the EKCO site history is presented in Table 1-1. In the 1940s, the EKCO facility in Massillon manufactured aluminum and stainless steel cookware. By 1951, with the United States involved in the Korean Conflict, the plant began manufacturing 90-mm and 105-mm shell casings for the military. The resulting increase in production necessitated the drilling of two production wells (W-1 and W-2) at the facility. In 1953, a sewer was constructed to carry the plant waste to a discharge point along Newman Creek. At approximately the same time, a surface impoundment was constructed along the northern property boundary adjacent to Newman Creek. Sludge resulting from waste treatment activities was discharged to the surface impoundment.

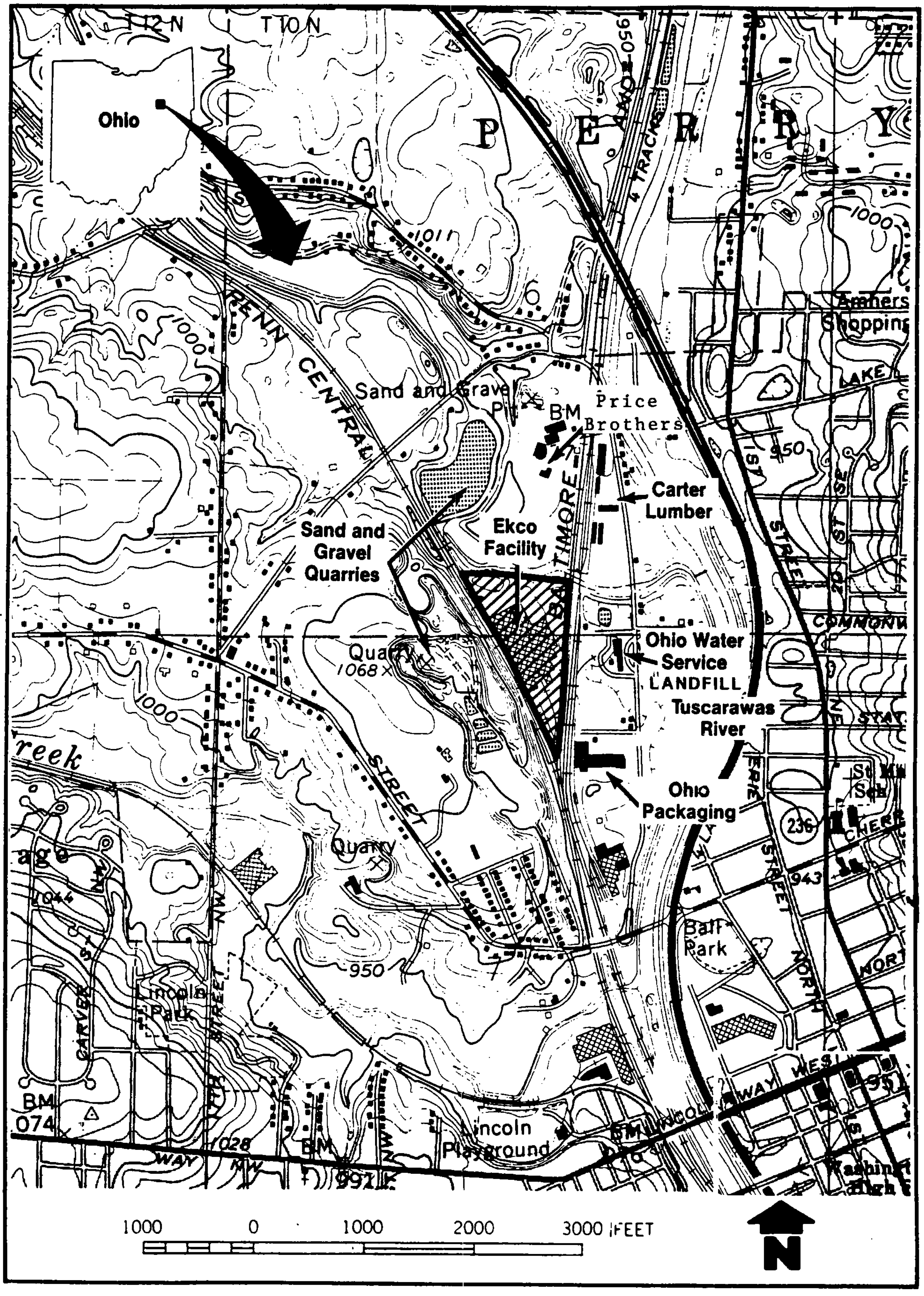

FIGURE 1-1 SITE LOCATION MAP
EKCO HOUSEWARES, INC., MASSILLON, OHIO
(Ref. 7.5 Minute Massillon Quad, Ohio, 1978)

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Table 1-1

EKCO Facility History

Date	EKCO Site Activity History
Circa 1929-32	First recorded activities at facility. Property is owned by Standard Oil Company.
Circa 1929-42	Fort Pitt/Massillon Bridge Works - Manufacture of iron and steel bridges and structural iron.
1945	Manufacturing Aluminum and stainless steel cookware.
1951	With the U.S. involvement in the Korean Conflict, the plant began manufacturing 90-mm and 105-mm shell casings for the military. This increase in production necessitates the drilling of two production wells (W-1 and W-2). Well W-1 has been used continuously since then, and well W-2 was used until it was taken out of service in the late 1970s.
1953	A surface impoundment was constructed along the northern property boundary adjacent to Newman Creek, Sludge frame waste treatment was discharged to it. Began copper-plating cookware; used primarily TCE or 1,1,1-TCA to clean cookware.
1964	Stopped using TCE; 1,1,1-TCA was used in its place.
1965	AHPC acquired EKCO Housewares.
1967	Installation of porcelain and teflon coating units.
1969	Surface impoundment meets newly formed NPDES regulations and permits.
July 1974	NPDES Permit No. C-3094BD was issued to EKCO.
1977	EKCO discontinued the manufacturing of aluminum and porcelain cookware and the use of the lagoon ceased.
1978	All copper plating operations ended; the principal manufactured products were pressed and coated nonstick bakeware.
1979-1980	The only major documented solvent spill to date at the facility was recorded; neither the exact location nor the extent of the spill was documented.
1980	The surface impoundments was reactivated under the existing NPDES permit and received alkaline degreaser filter water.
March 1984	In applying for a renewal of their NPDES permit, the plant was required to analyze on-site well water for VOCs, this analysis indicated the presence of 1,1,1-TCA and TCE.
June 1984	All discharges to lagoon ceased.
1984	AHPC sold EKCO Housewares to the EKCO Group.
March 1986	The air stripper system was installed and put into service.
May 1992	EKCO reported a 330-gallon 1,1,1-TCA spill to EPA. EKCO removed 50 tons of soil from the area of the solvent release.
Present	EKCO continues to manufacture pressed and coated nonstick bakeware. A silicon-based compound is presently used to coat the bakeware to create the nonstick surface.

During 1954, EKCO began coating cookware manufactured at the facility. Solvents, primarily trichloroethylene (TCE) or 1,1,1-trichloroethane (1,1,1-TCA), were used to clean the products prior to coating. Sometime during the mid 1960s, EKCO stopped using TCE; however, the use of TCE was reinitiated in the 1980s.

In 1965, American Home Products Corporation (AHPC) acquired EKCO Housewares. Porcelain and teflon coating units at the EKCO facility were installed in 1967. In 1969, with the development of new National Pollutant Discharge Elimination System (NPDES) regulations and permit requirements, the surface impoundment was approved and permitted by the State of Ohio to discharge waste products associated with plant activities. These waste products have included:

- Deionizers from copper coating operations (hydrochloric acid and sodium hydroxide).
- Washings and waste material from manufacturing porcelain/teflon-coated aluminum cookware (aluminum frit, various pigments: inorganic oxides of lead, cadmium, selenium, and cobalt).
- Alkaline washer fluids used to clean aluminum cookware.

In July 1974, NPDES Permit No. C-3094BD was issued to the EKCO facility. As the 1970s progressed, EKCO discontinued the manufacturing of aluminum and porcelain cookware and use of the lagoon ceased in 1977. By the end of 1978, all copper coating operations had ended and the principal products manufactured at the facility consisted of pressed and coated nonstick bakeware.

Correspondence between EKCO and the Ohio Environmental Protection Agency (OEPA) identified a solvent spill that had occurred between 1979 and 1980 as the only major recorded spill at the facility. The spill was in the vicinity of process water well W-10 (Figure 1-2). Neither the exact location nor the extent of the spill was documented. It should be noted that W-10 is located in a sump and is covered with a grate flush with the plant floor, which makes the well head vulnerable to floor drainage. In 1992, EKCO reported to EPA a 50-gallon spill of 1,1,1-TCA on the western side of the building.

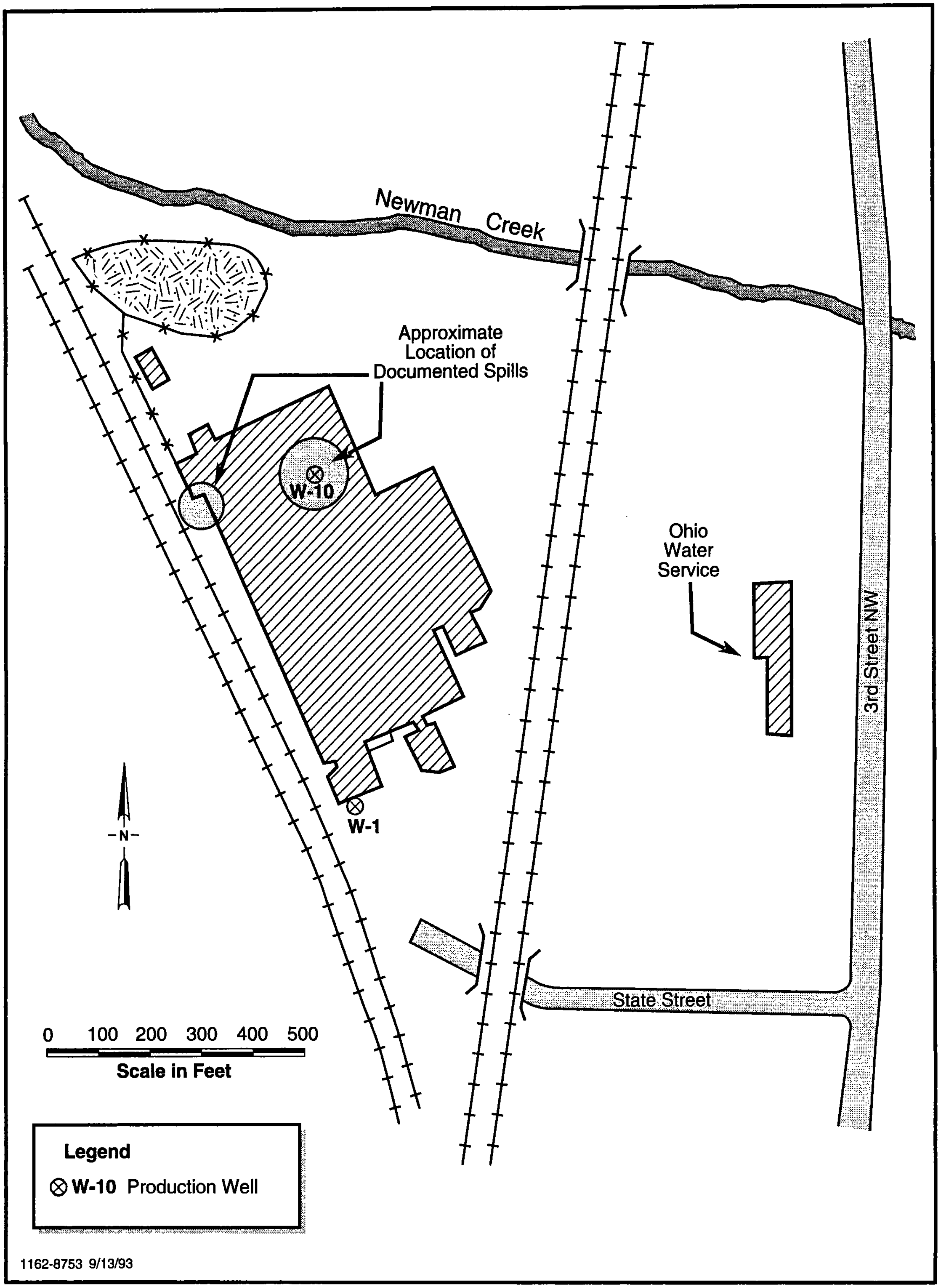


FIGURE 1-2 APPROXIMATE LOCATION OF THE DOCUMENTED SPILLS

In 1984 AHPC sold EKCO Housewares to the EKCO Group.

The surface impoundment was reactivated in 1980 under the existing NPDES permit and received degreaser filter water until mid-1984.

In March 1984, when the plant applied for a renewal of its NPDES permit, an analysis of on-site well water for volatile organic compounds (VOCs) was required. The analysis indicated the presence of 1,1,1-TCA and TCE. This discovery resulted in subsequent investigations at EKCO. These investigative activities are described in Subsection 1.4 of this report.

EKCO continues to manufacture pressed and coated nonstick bakeware at the Massillon facility. A silicon-based compound is presently used to coat the bakeware to create the non-stick surface.

1.2.3 Environmental Setting

1.2.3.1 Climate

Information obtained from the Akron/Canton office of the National Weather Service reveals an average precipitation rate of 35.90 inches per year based on records for a 30-year period, 1951 to 1980 inclusive. The average windspeed is 10 mph and is primarily to the south. The average yearly snowfall is 37.5 inches, and the average cloud cover is 0.7 inch. The mean annual Class A pan evaporation interpreted from a map in the Weather Bureau Technical Paper No. 37 is approximately 40 inches per year. Information regarding the pH of the precipitation in Stark County is not available. In addition, the 25-year/24-hour rainfall is listed in Weather Bureau Technical Paper No. 40 to be approximately 4 inches for Stark County, Ohio.

1.2.3.2 Topography

The EKCO facility is approximately triangular in shape. It is bounded on two sides by railroad tracks and on the third by Newman Creek. The majority of the facility is generally flat. The northern edge of the facility slopes steeply toward Newman Creek. A topographic map of the facility is included in Figure 1-3. Surface water runoff at the facility discharges to Newman Creek by two pathways: surface runoff on the northern part of the facility flows directly into Newman Creek, and surface discharge from the remainder of the facility is routed through the storm sewer system, which discharges through Outfall No. 001 into Newman Creek. A site plan showing the storm sewer system is included in Figure 1-4.

A portion of the facility is located within the 100-year floodplain of Newman Creek as shown in Figure 1-3.

1.2.3.3 Regional Geology

<u>Unconsolidated Material</u>

Most of Stark County, Ohio, has been covered by at least two continental ice sheets, resulting in variable surficial geologic conditions. The glaciers covered the land surface with a veneer of glacial drift deposits, which range from fine clay particles to boulders. The glacial drift thickness generally ranges from less than 25 ft to approximately 100 ft. In the areas of buried valleys, this unconsolidated material can exceed 500 ft in thickness (Ohio Department of Natural Resources, 1972).

<u>Bedrock</u>

Underlying the glacial drift and outwash deposits are sedimentary rocks of the Pennsylvanian, Mississippian, and Devonian geologic systems. These bedrock formations dip generally to the southeast at approximately 20 to 40 ft per mile and consist of sandstone and shale with some interbedded coal and occasional thin limestone units (Cross, 1959).

Table 1-2 summarizes the generalized stratigraphic sequence for the Middle Tuscarawas River Basin.

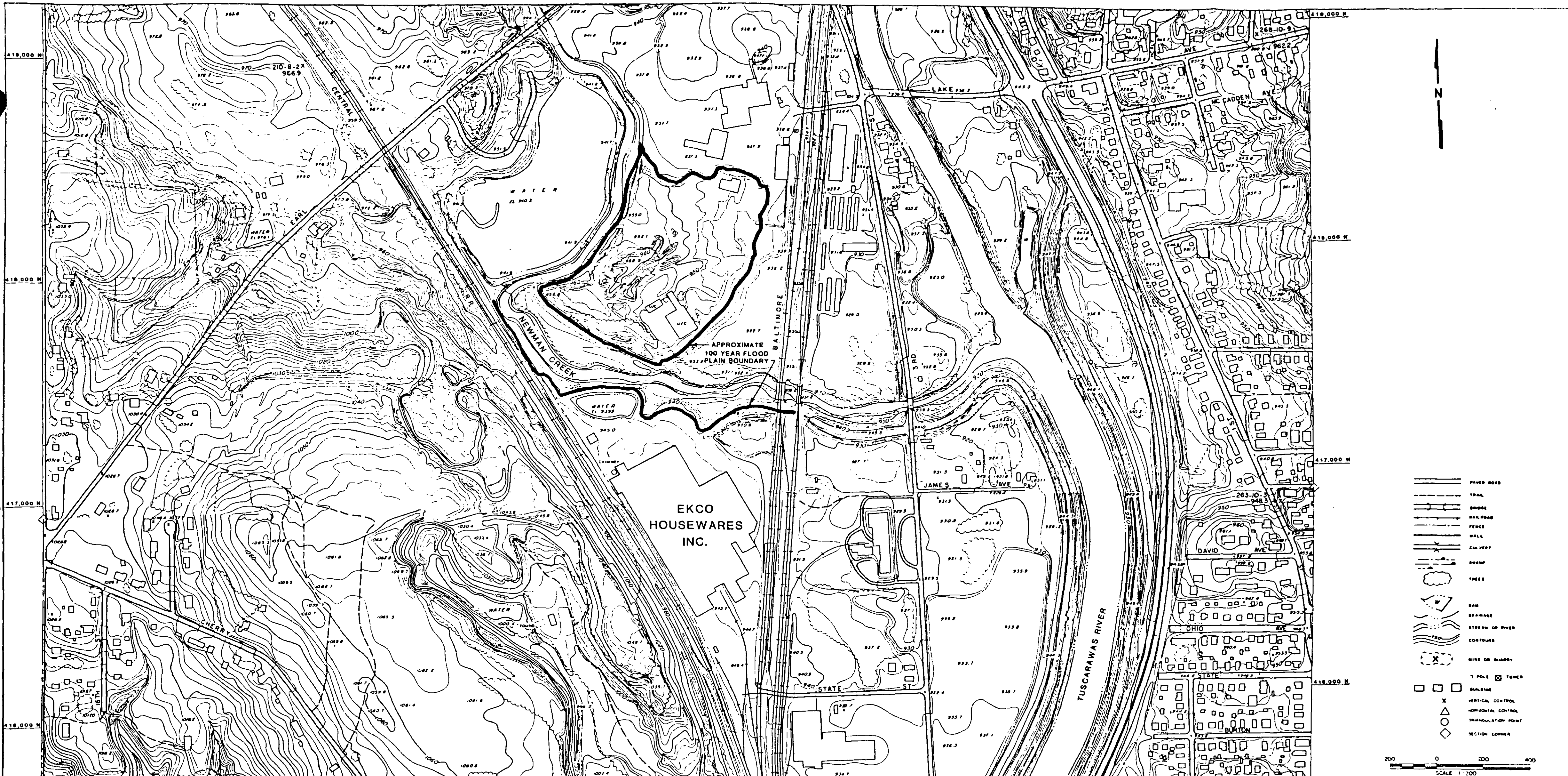
1.2.3.4 Regional Hydrogeology

__Unconsolidated Material__

The western portion of Stark County lies within the Middle Tuscarawas River Basin. The units capable of providing sufficient quantities of groundwater to domestic, commercial, and municipal wells underlying this basin include the unconsolidated deposits of sand and graveland the consolidated layers of sandstone, shale, limestone, and coal. Yields may range from less than 1 gallon per minute (gpm) from clay and shale deposits to more than 1,000 gpm from thick, permeable sand and gravel deposits (Schmidt, 1962). The generalized stratigraphic table (Table 1-2) briefly describes the physical and water-producing characteristics of the units within the Tuscarawas River Basin. Figure 1-5 illustrates the availability and yield of groundwater in the western portion of Stark County.

The outwash deposits beneath the flood plain of the Tuscarawas River have the greatest potential for the development of large groundwater supplies in this basin. Yields from properly developed wells in this unit range from 500 to more than 3,000 gpm. The majority of these wells are developed at depths less than 160 ft (Schmidt, 1962).

Many of the tributaries to the Tuscarawas River are also underlain by thick outwash deposits composed predominantly of clay interbedded with layers of fine sand and gravel. Portions of these tributary valleys are filled with as much as 270 ft of unconsolidated deposits (Schmidt, 1962). The average yield of these deposits is less than 25 gpm because of the predominance of clay, and water wells are typically drilled through these unconsolidated deposits to the underlying bedrock.



by
PHOTOGRAMMETRIC
SERVICES, INC.
Columbus, Ohio

STARK COUNTY
TOPOGRAPHIC MAP
JOSEPH A. STURRETT, County Engineer
Board of County Commissioners
JOSEPH J. SOMMER
NORMAN W. SPONSELLER - ALBERT M. CREIGHTON
1970
T 10 R 9 Sec. 6 PERRY

EKCO HOUSEWARES INC.
MASSILLON, OHIO

WESTON

CHECKED	DATE	CLIENT APPROVALS	DATE
DES. ENG.			
PROJ. ENG.			
PROJ. MGR.			
APPROVED			
APPROVED		ISSUED FOR	DATE

RCRA PART B PERMIT APPLICATION
DECEMBER 1988

DRAWN	DATE	
P. WHITEMAN	12-7-88	**FIGURE 1-3**
SCALE AS SHOWN	W.O. NO. 2994-02-03	

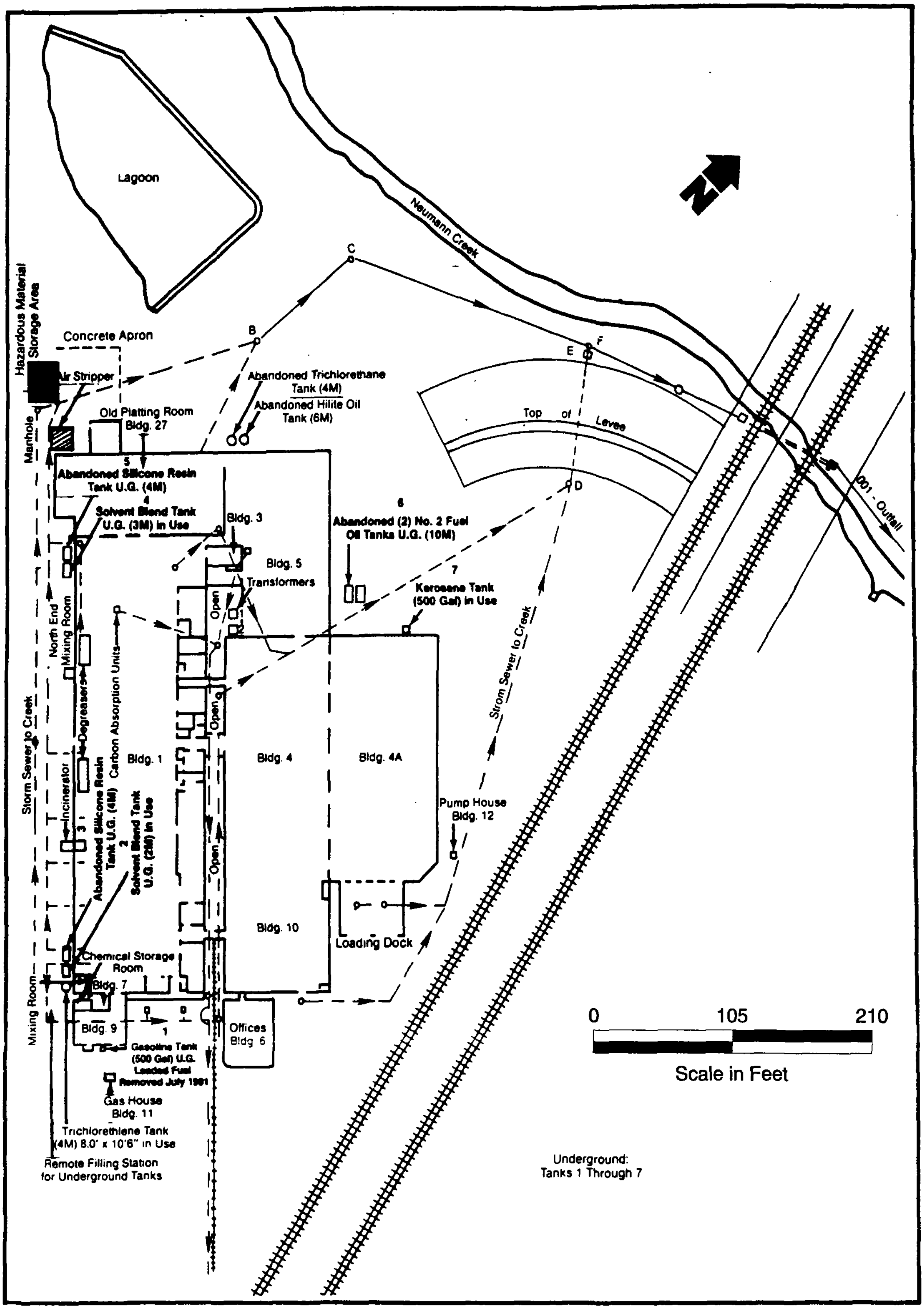


FIGURE 1-4 FACILITY DESCRIPTION AND LOCATION EKCO HOUSEWARES, INC., MASSILLON, OHIO

Table 1-2

Generalized Stratigraphic Sequence in the Middle Tuscarawas River Basin

Series or System	Group or Formation	Character of Material	Water-Bearing Characteristics
Quaternary		Clay, silt and alluvium deposited on the flood plains of the principal valleys.	Generally a poor source of groundwater because of limited thickness and absence of coarse materials.
Quaternary Pleistocene		Interbedded and interlensing layers of sand, gravel, and clay deposited in the buried valleys by glacial meltwaters. Thick layers of silt and clay interbedded with relatively thin lenses of sand and gravel.	Quantity of available water depends on character of material and source of recharge. Properly developed wells yield in excess of 1,000 gpm. Drilled wells developed in the sand and gravel yield 5 to 15 gpm.
Pennsylvanian	Pottsville	Alternating layers of shale, sandstone, limestone, and coal. Thin to thick, coarse-grained sandstone.	Yields sufficient water for farm and domestic needs. Domestic, farm, and industrial supplies are readily available. Yields of as much as 500 gpm reported. However, regional yield seldom exceeds 15 gpm.
Mississippian		Alternating layers of sandstone and shale.	Farm and domestic supplies are readily developed. If thick shale formations predominate, meager groundwater supplies are developed.

Source: Schmidt, 1962.

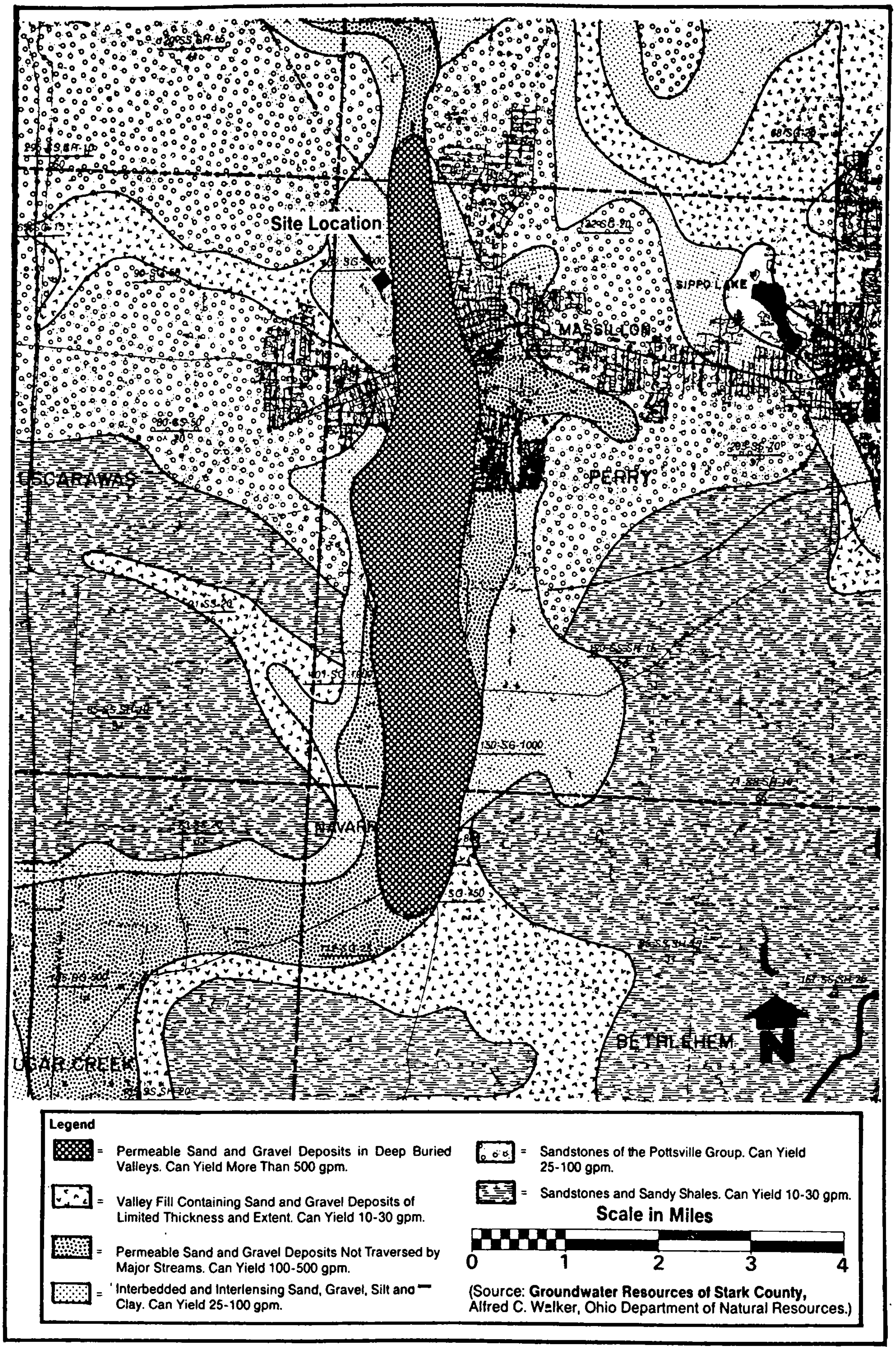


FIGURE 1-5 GROUNDWATER RESOURCES OF MASSILLON, OHIO

Bedrock

The bedrock underlying the glacial deposits in the basin consists of interbedded, thin to thick layers of sandstone, shale, coal, and occasional limestone. All of these are part of the Pottsville group of Pennsylvania age. Because of the vertical variations in lithology, and hence permeability, within the Pottsville formation in the area, groundwater wells reportedly range in depth from 46 ft to 500 ft. It has been reported that yields of groundwater range from less than 1 to more than 500 gpm (Schmidt, 1962). The average domestic well is 170 ft in depth and yields about 8 gpm. Yields of commercial and municipal wells developed in the sandstone units of the lower Pottsville formation are reported to range from 25 to 100 gpm (Walker, 1979); however, higher yields are possible, as evidenced by the recovery rates of W-1 (about 230 gpm) and W-10 (about 300 gpm), which were hydrofractured with 200 pounds of dynamite.

1.2.3.5 Local Groundwater Usage

Ohio Water Service Municipal Wells

Currently, the Ohio Water Service Company (OWS) has seven active production wells (OWS-1, 2, 3, 5, 7, 8, and 9), and one well (OWS-4) that was abandoned and subsequently converted into an observation well. OWS-1, 2, and 3 are located approximately 2,000 ft northeast of the EKCO facility and 150 to 200 ft east of the Tuscarawas River (Figure 1-6). OWS-5 is located approximately 4,200 ft north of the facility and 100 ft west of the Tuscarawas River. OWS-7, 8, and 9 all lie approximately 1.6 miles north of the EKCO facility and are approximately 100 ft west of the Tuscarawas River. The abandoned well, OWS-4, is currently being used as a monitoring well and is located 1,000 ft east of the facility and approximately 500 ft west of the Tuscarawas River.

The OWS well field pumps approximately 7.5 million gallons per day (gpd) from the production wells. Individual wells are pumped at varying rates to maintain this production. Only three wells are normally run at any one time. When running, the rates at which OWS-1, 2, 3, 5, 7, 8, and 9 are pumped are approximately 2,800, 1,260, 350, 2,450, 2,100, 2,100,

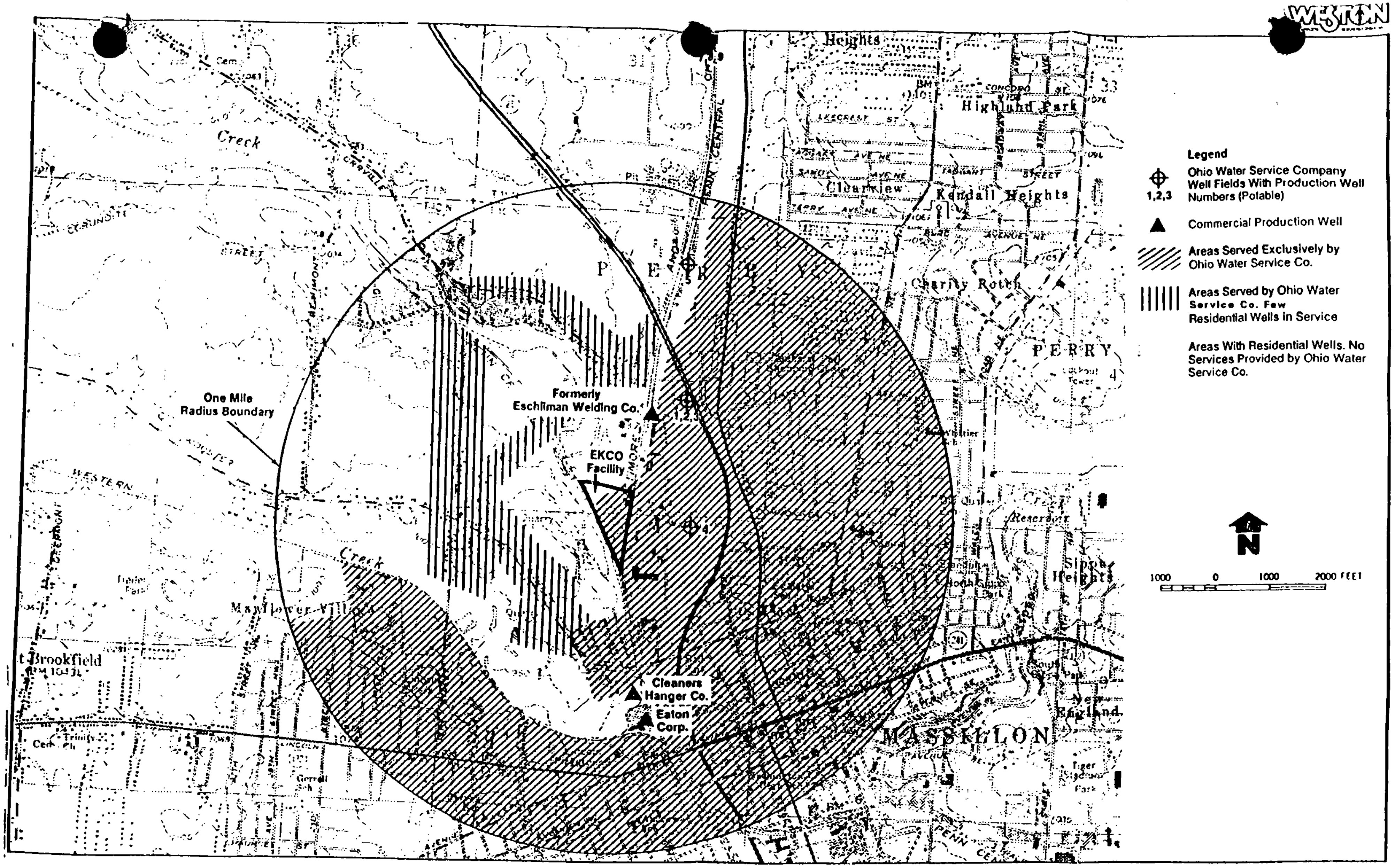


FIGURE 1-6 **WATER SUPPLY MAP WITHIN ONE MILE RADIUS OF THE EKCO FACILITY BOUNDARY**

(Ref 7.5 Minute Massillon Quad Ohio 1978) and 2,000 gpm, respectively. All of the OWS wells are reported to have been constructed with 50-ft screens and reach total depths of 150 to 160 ft, with the exception of OWS-5, which was reportedly screened in the unconsolidated material lying on top of the bedrock.

Private Wells

Approximately 50 domestic wells and three commercial wells are located within a 1-mile radius of the EKCO facility. No information is available on the depth of the domestic wells. The average depth of the three commercial wells is 225 ft. The location of these wells is shown in Figure 1-6.

1.2.3.6 Demography

Population

Based on the estimated 1990 census, 62,000 people live within 4 miles of the center of the EKCO facility. The surrounding land is largely industrial and urbanized. The most densely settled areas are located to the east of the site.

Employment

EKCO employs approximately 350 people in a 24-hour-per-day, 5-day-per-week operation.

1.2.4 Previous Environmental Investigations

1.2.4.1 Ohio Drilling, Inc. and Floyd Brown Associates, Limited (FBA) Investigations (1984-1987)

In 1984, with the discovery of 1,1,1-TCA and TCE in the groundwater beneath the plant, EKCO initiated a number of activities to investigate the problem. During the months of September and October 1984, seven test holes were drilled by Ohio Drilling, Inc. at the facility. Four test holes (TH-1-84 through TH-4-84) were drilled into the overburden, and the remaining three were drilled into bedrock. Soil and water samples were collected from all locations and revealed varying levels of VOCs. Two of the shallow test holes, TH-1-84 and TH-2-84 were completed as 1¼-inch inside diameter (i.d.) piezometers (P-1-84 and P-2-84, respectively), while the remaining two were plugged. All three of the bedrock test holes were completed as 6-inch (i.d. casing) bedrock wells (R-1 through R-3) with dedicated pumps. Samples obtained in 1984 indicated the presence of VOCs including trichloroethene, dichloroethene, and vinyl chloride. An additional bedrock well (R-4) was installed in July 1985 along the eastern property boundary. No contaminants were found in samples collected from this well.

Because the then out-of-service production well (W-10) was centrally located on the EKCO property, it was decided that a pump and treat program using this well would be initiated at the facility to control VOCs. With the concurrence of OEPA, an air stripper was installed by Ohio Drilling, Inc. in February 1985.

On 17 June 1986, Floyd Brown Associates, Limited (FBA) developed a preliminary closure plan for the lagoon. The closure plan led to a Phase I screening investigation of the lagoon, which involved the installation of 12 soil borings. The results indicated elevated levels of cadmium, chromium, and lead in soil samples collected within the lagoon and in locations between the lagoon and Newman Creek. No VOCs were detected in any of the composited samples. The *Groundwater Quality Assessment Plan for EKCO Housewares* (WESTON, March 1988) provides a summary of FBA's analytical results and the locations of these wells and borings.

The Phase I investigation led to a more intensive Phase II soil boring program conducted by FBA in January and February 1987. The program involved installation of 25 additional soil borings. Four of these soil borings (D-1-27, D-2-30, D-3-17, and D-4-30) were completed as 1½-inch (i.d.) PVC wells and were retained as monitoring points for the lagoon. Results indicate elevated concentrations of the metals of cadmium, chromium, and lead in soils to the maximum depth of the borings. However, this situation is localized in the area near the inlet of the lagoon. Maximum concentrations near the surface of 8,400-ppm cadmium, 2,630-ppm chromium, and 19,500-ppm lead were detected.

1.2.4.2 WESTON Investigations (1987-1992)

In July 1987, WESTON was contracted to begin development of a final closure program for the lagoon and to develop a groundwater quality assessment program for the entire EKCO facility. In September 1987, WESTON conducted an assessment to collect baseline information and to determine the need for interim corrective measures. This included the following activities:

- Sampling of OWS-4 and all on-site wells (except the out-of-service process water well, W-2) to establish baseline data for each well and collecting well data (OVA readings, construction details, depth to water measurements, etc.).
- Surveying all on-site wells.
- Conducting a groundwater utilization survey that included identifying and locating domestic, commercial, and municipal wells within a 1-mile radius of the site.
- Reviewing plant records and other available documents, which included aerial photographs, tax maps and geologic references.

VOCs were detected in on-site shallow and bedrock groundwater monitoring wells. The major compounds detected were TCE, 1,1,1-TCA, and their breakdown products. The results of the initial investigation are presented in the *Interim Measures Report* (WESTON, February 1988). While no immediate threat to potable water supplies was identified, WESTON recommended that on-site pumpage be increased, if practical, in order to enhance contaminant recovery and hydraulic control of groundwater underlying the plant.

A groundwater quality assessment program for the EKCO facility was initiated during the summer of 1988. The general purpose of this effort was to address groundwater conditions at the facility proceeding under Section 3008(h), as amended, U.S.C. 6928(h), and as part of the closure plan for the surface impoundment. The results of this program are presented in the *Groundwater Quality Assessment Report* (WESTON, 1990).

RFI field activities commenced in April 1991. The objectives of the RFI were to:

- Evaluate groundwater flow directions.
- Evaluate the horizontal and vertical extent of chemicals in groundwater.
- Evaluate the depth and extent of chemicals in soil.
- Identify potential sources of chemicals detected in soils and groundwater.
- Evaluate the effectiveness of the presently operating groundwater remediation system in recovering released chemicals.

The results of this program are presented in the *RCRA Facility Investigation Report* (WESTON, 1992) and are summarized below.

1.3 NATURE AND EXTENT OF CONTAMINATION

1.3.1 Geology Summary

The EKCO facility is situated on the western flank of a glacial valley that extends to the north and south and was carved from Pennsylvanian age sedimentary rocks during the Pleistocene glaciation. Prior to the construction of the facility in 1945, a cover of fill material was used to level the natural glacially-formed topography at the building site. The glacially deposited sediments form a thin veneer less than 20 ft thick in the western portion of the site where bedrock is shallow. In the eastern portion of the site, the sediments infill the glacial valley, reaching a maximum thickness of greater than 252 ft.

Based on the vertical distribution of the glacial sediments encountered during drilling, seven separate layers of unconsolidated material were identified and correlated between monitor wells at the site. Three high permeability sand and gravel units were identified, separated by four low permeability silt and clay units. Underlying the glacial sediments, bedrock is encountered at its highest elevation in the northwestern portion of the site and slopes to the east at an approximate 17° angle. Bedrock encountered at the site consists of four interbedded layers. The shallowest bedrock unit encountered consists of an interbedded low permeable shale and argillaceous sandstone, which is underlain by a high permeable, well sorted sandstone. The sandstone unit is the primary bedrock water bearing unit at the site. Below the sandstone is another low permeable interbedded shale and argillaceous sandstone unit, which is directly underlain by shale.

1.3.2 Hydrogeology Summary

The vertical stratigraphy at the site is divided into four distinct permeable hydrostratigraphic units, i.e., shallow sand and gravel, intermediate sand and gravel, deep sand and gravel, and sandstone bedrock. These high permeable units are separated by low permeable clay and silt or shale and argillaceous sandstone. In general, the sand and gravel and the sandstone units act as the primary medium for groundwater flow and the low permeable silt, clay, shale and argillaceous sandstone act as barriers to groundwater flow; however, variations in permeability occur locally, and they are not laterally continuous across the site. There are five groundwater production wells in the area of the site, all of which have an effect on the groundwater flow system. EKCO uses the two sandstone bedrock production wells, W-1 and W-10, pumping at a total of approximately 600 gpm to provide water for the manufacturing facility. OWS pumps the three production wells (OWS-1, 2, and 3) intermittently from the deep sand and gravel up to 2,800 gpm to provide water for the City of Massillon.

Groundwater contour maps for the site indicate that the pumping of the EKCO production wells W-1 and W-10 appreciably affects the groundwater flow in the shallow, intermediate, and the bedrock water-bearing zones. On-site recovery wells do not have any effect on the deep sand and gravel layer that overlies the bedrock. The flow system in this interval is governed by the OWS wells, which pull the groundwater to the north. A drawdown cone exists in these three units around wells W-1 and W-10. As a result of the pumping, the groundwater in the shallow, intermediate, and bedrock water-bearing zones under the entire site is flowing directly toward production wells W-1 and W-10, and does not flow off-site.

Groundwater in the deep sand and gravel water bearing unit (which is present adjacent to the facility but not under it) flows directly north toward the pumping OWS production wells OWS-1, 2, and 3.

1.3.3 <u>Geochemistry</u>

1.3.3.1 Source Identification

Based on soil borings advanced in 1988 and 1991, the following three VOC source areas were identified and are displayed on Figure 1-7.

- Tank area at southwestern end of plant.
- Sump at production well W-10.
- Tank area at northern end of plant.

TCE was the primary constituent detected at the tank area at the southwestern end of plant. TCE contamination was detected at 140 ppm in WESTON's shallow boring and at 2 ppm at 6 to 8 ft in another boring. In the tank area at the northern end of the building, TCE and dichloroethene (DCE) were the primary constituents detected. TCE was detected at all depth intervals in borings installed at the northern end of the building. DCE was detected at 34 ppm in one boring installed through the floor of the building.

Four underground storage tanks (USTs) (tanks 2 through 5) were leak-tested and found to be tight.

1.3.3.2 Groundwater Geochemical Summary

Groundwater sampling was conducted at the EKCO site in December 1988, September 1991, and March 1992. The monitoring wells are shown in Figure 1-8. In addition to these three sampling events, selected wells have been sampled quarterly since 1989 as part of the lagoon closure. Groundwater sampling has been conducted for both VOCs and metals.

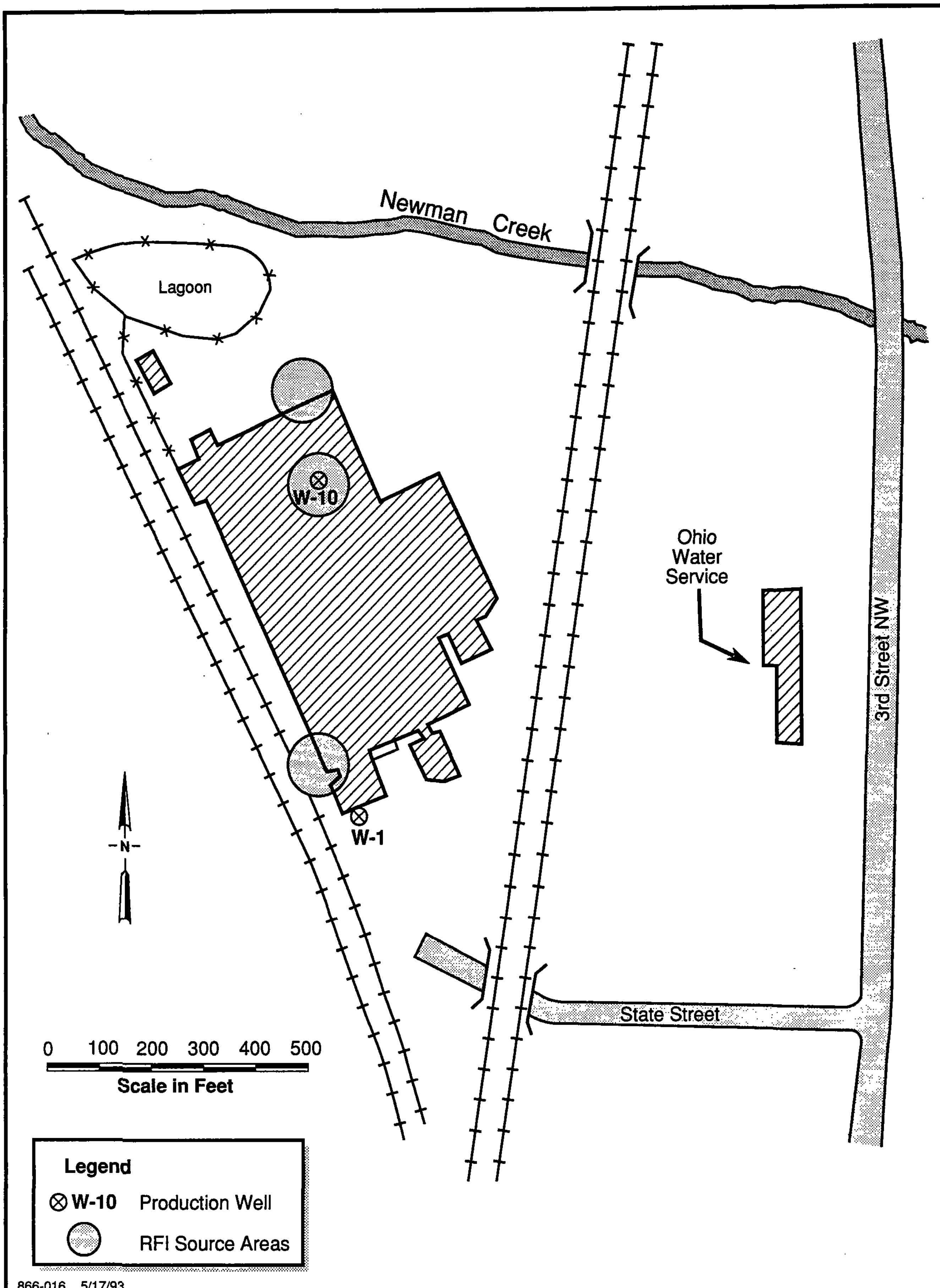


FIGURE 1-7 VOC SOURCE AREAS IDENTIFIED DURING THE RFI

The VOCs detected in the groundwater were predominantly TCE, 1,1,1-TCA, and their respective breakdown products. The results indicate that high concentrations of TCE and 1,1,1-TCA occur in the shallow groundwater near the source area north of the plant near well D-4-30, in the intermediate groundwater at Well I-2, and in the bedrock groundwater near wells W-10, R-1, and R-2. The percentage of breakdown products increases with increasing distance from the source areas at wells W-10 and D-4-30. Groundwater in the shallow, intermediate, and bedrock water bearing zones is staying on-site and flowing toward the production wells, W-1 and W-10. Groundwater in the deep sand and gravel layer overlying the bedrock is moving away from the site towards the OWS-1, 2, and 3 wells. VOCs that were released into this layer in the past have caused OWS-4 to be shut down, and they are moving towards OWS-1, 2, and 3, which have not yet become contaminated.

Shallow groundwater sampling results indicate that there is a separate and relatively new off-site TCE source approximately 500 ft north of the EKCO site at Well S-12. The exceptionally high level of TCE and the absence of any appreciable breakdown products indicate that it is a fairly recent TCE release, and it is unrelated to activities that have occurred at the EKCO site. However, the leading edge of the plume originating from EKCO within the bedrock aquifer is located under this point in well R-12.

1.4 INTERIM RESPONSE ACTIONS

1.4.1 EKCO Recovery Wells

There are currently two on-site production wells (W-1 and W-10) being used as recovery wells. W-1 is located near the southern corner of the building, and W-10 is about 800 ft north of W-1 and inside the building (Figure 1-2).

W-1 is completed as an open hole well in bedrock to a total depth of 225 ft. At this location, shale was encountered at 25 ft, followed by a series of interbedded sandstones and shales. Construction details for W-10 are unavailable at this time, but it is believed to be cased to bedrock (approximately 60 ft) and completed as an open hole well in bedrock to a total depth similar to that of W-1.

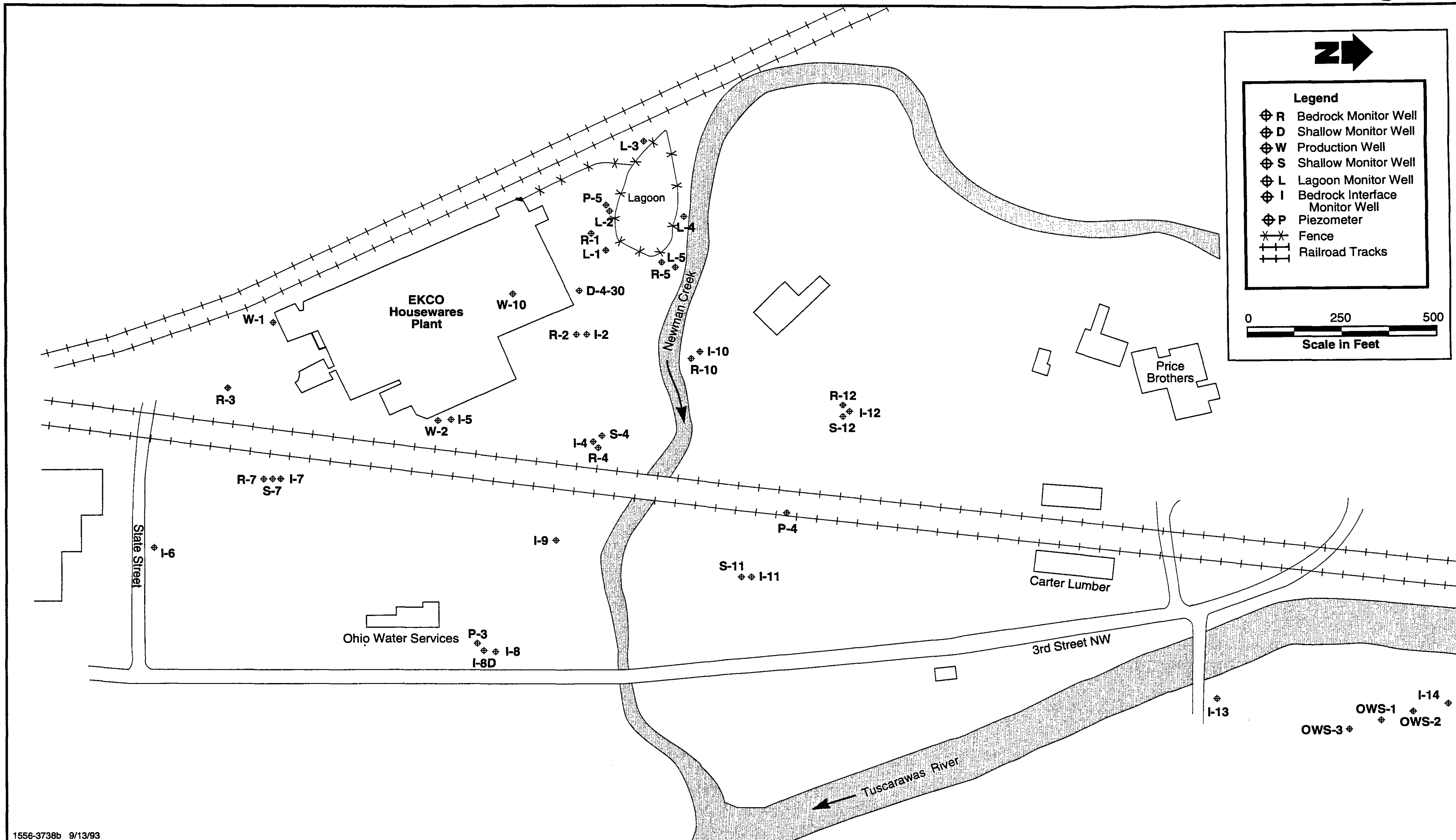


FIGURE 1-8 MONITOR WELL LOCATION MAP

The pump-and-treat recovery system began in February 1986 with the concurrence of OEPA. When the system was instituted, W-1 pumped 240 gpm and W-10 pumped 140 gpm. Available records indicate that these pumping rates were fairly constant through the first 2 years of the pump and treat program. During this time, flow rates reportedly varied about 10 to 15 gpm. In April 1988, the pumping rate of W-10 was increased to 255 gpm, while the rate of W-1 remained fairly constant at 245 gpm. Records indicate that W-10's pumping rate was increased to 305 gpm in May, 330 gpm in August, and 375 in September. The rates of W-1 remained constant at 245 gpm. In December 1988, W-10's rate was 345 gpm and W-1's was 245 gpm. Pumping rates and VOC levels in W-1 and W-10 during 1990 and 1991 are shown in Table 1-3. Total VOC levels in the recovered groundwater were 18 mg/L in 1986. By 1987 total VOC levels had dropped to 8 mg/L. During 1990, 1991, and 1992, total VOC levels were 1,426 μg/L, 1,278 μg/L, and 1,459 μg/L, respectively.

Four water-bearing units have been identified in the area of the EKCO facility: the shallow, the intermediate, the deep, and the bedrock. However, the deep aquifer begins at the eastern edge of the EKCO property and is the principal aquifer used by the OWS. Of these, only the deep aquifer is not present below the EKCO facility. Groundwater contour maps of the shallow, intermediate, and bedrock water-bearing units indicate that the groundwater in these units is flowing toward the production wells, W-1 and W-10. Because all of the groundwater at the facility in these three units is flowing toward production wells W-1 and W-10, any VOCs that exist in the groundwater at the facility are being captured by the site production wells and treated by the on-site air stripper system.

In summary, the results of the RFI indicate that VOC-contaminated groundwater is not migrating off-site. VOC contamination migrated into the deep aquifer in the past, and this contamination is currently migrating towards the OWS wells to the north. Therefore, users of groundwater supplies off-site in the area are not receptors, either actual or potential, for the migration of contaminated groundwater.

WESTON MANAGERS DESIGNERS/CONSULTANTS

Table 1-3

Pumping Rates and Total VOCs for Recovery Wells W-1 and W-10

W-1 Well Samples	Pumping Rate (gpm)	Water Treated (gallon)	Total VOCs (µg/L)	W-10 Well Samples	Pumping Rate (gpm)	Water Treated (gallon)	Total VOC (µg/L)
2/1/90	250	9,595,000	142	2/1/90	360	13,996,200	1,923
3/5/90	260	11,648,000	117	3/5/90	360	16,368,200	2,173
4/3/90	260	10,847,000	109	4/3/90	350	14,577,000	1,832
5/2/90	260	10,799,000	131	5/2/90	340	14,133,099	2,849
6/4/90	255	12,310,000	146	6/4/90	330	16,000,700	2,597
7/6/90	265	11,946,000	173	7/6/90	330	15,051,200	2,540
8/3/90	260	10,541,000	173	8/3/90	320	13,180,600	2,378
9/5/90	260	12,319,000	158	9/5/90	325	13,845,800	2,140
10/2/90	260	10,020,000	150	10/2/90	340	12,895,300	2,163
11/1/90	260	11,106,000	132	11/1/90	350	14,958,000	2,776
12/4/90	260	12,120,000	150	12/4/90	340	16,588,600	3,069
1/7/91	260	12,470,000	180	1/7/91	335	16,720,500	2,850
2/1/91	260	9,342,000	173	2/1/91	340	12,085,300	2,153
3/8/91	255	12,871,000	179	3/8/91	335	16,758,399	2,286
4/1/91	250	8,634,000	175	4/1/91	325	11,265,200	1,873
5/1/91	210	9,789,000	181	5/1/91	320	13,868,800	1,610
6/4/91	210	10,055,000	264	6/4/91	310	15,440,399	2,384
7/1/91	205	3,211,920	303	7/1/91	260	4,938,500	2,436
8/1/91	200	9,156,000	248	8/1/91	265	11,861,600	1,965
9/3/91	210	9,767,000	302	9/3/91	270	12,835,400	2,182
10/3/91	200	8,452,000	233	10/3/91	280	11,722,800	1,876
11/5/91	205	9,507,000	208	11/5/91	265	12,592,500	1,498
12/13/91	205	10,847,000	256	12/13/91	265	14,287,000	1,554
1/6/92	280	2,882,000	-	1/6/92	280	9,372,000	1,594
2/7/92	-	-	-	2/7/92	285	12,845,900	1,744
3/6/92	205	5,313,600	4726	3/6/92	270	4,729,100	3,928
4/13/92	220	12,038,400	138	4/13/92	240	10,656,900	827

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Table 1-3

Pumping Rates and Total VOCs for Recovery Wells W-1 and W-10 (Continued)

W-1 Well Samples	Pumping Rate (gpm)	Water Treated (gallon)	Total VOCs (μg/L)	W-10 Well Samples	Pumping Rate (gpm)	Water Treated (gallon)	Total VOC (μg/L)
5/5/92	220	6,857,000	174	5/5/92	235	7,570,000	1,418
6/2/92	210	8,584,000	218	6/2/92	265	10,566,300	1,206
7/1/92	220	8,757,000	71	7/1/92	270	10,848,400	1,470
8/4/92	230	10,365,000	165	8/4/92	275	13,297,500	1,538
9/2/92	220	9,155,000	169	9/2/92	280	11,747,000	1,830
10/3/92	230	9,566,000	177	10/3/92	295	12,405,700	1,226
11/3/92	230	10,296,000	148	11/3/92	305	13,744,400	1,489
12/8/92	230	11,646,000	175	12/8/92	300	15,364,800	1,298
1/6/93	230	10,086,000	135	1/6/93	310	13,320,800	666
2/3/93	245	9,073,000	183	2/3/93	315	11,889,900	2,162
3/2/93	230	9,065,000	135	3/2/93	300	11,764,300	1,420
4/1/93	230	8,373,000	162	4/1/93	310	12,000,900	1,954
5/3/93	235	10,938,000	136	5/3/93	305	14,383,000	1,673
6/1/93	230	9,408,000	ND	6/1/93	310	12,023,000	1,592

*ND: None detected

1.4.2 Air Stripper Discharge

Groundwater from production wells W-1 and W-10 is treated in an on-site air stripper, then discharged to Newman Creek via an underground storm sewer. A layout of the storm sewer system is shown in Figure 1-4. A comparison of VOC levels at the air stripper discharge and at the outfall indicate the VOC levels actually increased by an order of magnitude at the outfall during the period of 1991 to 1992. The VOC results are presented in Table 1-4.

An investigation of the sewer was performed in June 1992 by PLS International. This investigation showed portions of the sewer that displayed substantial deterioration. The section of the piping from Manhole A to Manhole B and from Manhole B to Manhole C, which conveys the discharged water from the air stripper, showed evidence of fractures, compression, and offsets. Failure of the piping may explain the increase in VOC levels between the air stripper discharge and the outfall. EKCO replaced the leaking piping between Manhole A and Manhole C in September 1992. Since replacement of the piping, VOC levels in the outfall have dropped to an average of 64 (μg/L). The average VOC levels in the air stripper discharge are still lower, 11 μg/L. Although not confirmed, contaminated sediments in the sewer may be the cause of this increase.

1.4.3 Soil Removal

In February 1992, EKCO reported to EPA a release of 330 gallons of 1,1,1-TCA in an area northwest of the plant. Some TCA entered a nearby storm sewer and reached the outfall at Newman Creek. TCA was recovered from the storm sewer using a vacuum truck. The portion of the storm sewer where the spill entered was blocked. Because TCA is heavier than water, an underwater weir was constructed at the sewer outfall, and 1-pound bags of activated carbon were placed on the upstream side of the weir to adsorb product. Fifty tons of soil were excavated in the presence of an OEPA representative. The soil was containerized and transported to the Envirosafe Services of Ohio, Inc. hazardous waste landfill in Toledo, Ohio.

Table 1-4

VOC Concentrations in Air Stripper Discharge

Date	Pumping Rate (gpm)	Total VOCs at Air Stripper Discharge (μg/L)[a]	Total VOCs at Outfall (μg/L)[b]
8/1/91	465	19	28
9/3/91	480	250	34
10/3/91	480	6	340
11/5/91	470	4	190
12/13/91	470	5	67
1/6/92	280	ND	28
2/7/92	285	167	2319
3/6/92	475	20	760
4/13/92	460	9	490
5/5/92	455	ND	350
6/2/92	495	ND	275
7/1/92	490	ND	398
8/4/92	505	ND	184
9/2/92	500	ND	47
10/3/92	525	11	24
11/3/92	535	26	16
12/8/92	530	13	14
1/6/93	540	5	NS
2/3/93	560	ND	16
3/2/93	530	ND	33
4/1/93	540	22	14
5/3/93	540	47	371
6/1/93	540	ND	41

[a]ND = None detected.
[b]NS = Not sampled.

1.4.4 Proposed Well Rehabilitation

As part of the RFI, a casing seat test was performed on well R-2 in April 1991. The results of this test indicate that the casing seal is leaking. The leaking seal allows groundwater to migrate downward from the overburden water-bearing units, through the annulus around the casing, to the sandstone bedrock water-bearing zone in the open borehole, causing the following problems:

- The leaking casing seat provides a conduit for groundwater to migrate from the overburden units, which currently contains approximately 3 mg/L of VOCs, to the sandstone unit, which currently contains approximately 1 mg/L of VOCs.
- The mixing of the overburden and bedrock groundwater at the well is causing misrepresentative analytical groundwater sampling results in the bedrock unit.
- The hydraulic connection between the overburden and the bedrock results in misrepresentative water levels, which can cause misinterpretation of groundwater flow.

The results of the RFI suggested that wells R-1, R-3, W-1, W-2, and W-10 may also be acting as conduits from the shallow and intermediate water-bearing units to the bedrock unit.

Based on these findings, interim remedial measures to rehabilitate these wells have been recommended. If required, a work plan will be submitted to EPA prior to implementation. For wells R-1, R-2, and R-3, the recommended solution is to retrofit these wells with 2-inch wells. These wells would be screened in the bedrock unit from 105 to 115 ft. A 50-ft-thick grout seal and a 2-ft bentonite seal would be placed between the existing 6-inch well and the new 2-inch well, effectively isolating the bedrock unit from the upper and intermediate unit. For wells W-1, W-2, and W-10, the recommended solution is to install 8-inch diameter casing liners in each well.

The implementation of this proposed interim remedial measure may impact the performance of the ongoing groundwater recovery system. The goal of the well rehabilitation measure is to reduce or eliminate hydraulic connections between the shallow and intermediate water-bearing units and the bedrock. The current system is preventing off-site migration of contaminants from the shallow, intermediate, and bedrock water-bearing units. The reduction or elimination of the existing hydraulic connections between the aquifers may reduce the current control of the shallow and intermediate water-bearing units using the production wells. The direction of the flow in these units may change, allowing contaminated groundwater to migrate off-site unless additional remedial actions are taken to control the shallow and intermediate water-bearing zones. Potential remedial actions are screened in Subsection 3.2.

without a valid permit. The Act provides the Director of OEPA with broad authority to achieve a stated goal of the Act; to achieve and maintain applicable standards of quality for Ohio's waters. A second goal of the Act is to provide the Director of OEPA with sufficient authority to qualify to administer the discharge permit system required under the Federal Water Pollution Control Act. To this end, the Director of OEPA developed a regulatory program that governs discharge of pollutants to surface waters and incorporates all necessary requirements of the federal act. The Director of OEPA has been authorized by EPA to administer the federal water pollution program. In addition to regulating discharges to surface waters pursuant to the federal act, the Ohio act also prohibits discharging to groundwater without a permit. The Ohio Water Pollution Control Regulations are found in OAC 3745:33, the Ohio SPDES permit regulations.

OEPA's water pollution control regulations also govern the discharge of industrial pollutants to municipal or privately owned treatment works (POTWs). These regulations are found in the Ohio Wastewater Treatment Regulations (OAC 3745:36), and ensure compliance with the Ohio pretreatment standards, which are found in the Ohio Effluent Guidelines and Standards (OAC 3745:3). These standards state that any industrial user of a POTW is required to obtain an indirect discharge permit.

The emission of air pollutants into the outdoor atmosphere is regulated in Ohio pursuant to the Federal Clean Air Act and the Ohio Air Pollution Control Laws (37 ORC 3704). The Ohio Air Pollution Control Laws cover any equipment capable of causing an emission of an air contaminant to the outdoor atmosphere that is installed or altered after 24 November 1967. The primary agency with the authority to implement and enforce the Ohio Air Pollution Control Laws is OEPA.

The Ohio Air Pollution Control Regulations (OAC 3745:15) were promulgated by OEPA pursuant to the Ohio Air Pollution Control Laws. The purpose of these regulations is to set forth requirements to maintain those levels of air quality that are consistent with the protection of the public health and the environment. Regulations applicable to the EKCO site include control of emissions of organic materials from stationary sources (OAC 3745:21-

07) and permits to operate and variances (OAC 3745:35). OAC 3745:21-07 states that no person shall discharge more than 40 pounds of organic material into the atmosphere in any 1 day, nor more than 8 pounds in any 1 hour, unless said discharge has been reduced by at least 85%. In addition, such discharges shall be reduced by one of the following processes:

- Incineration, whereby 90% or more of the carbon in the organic material being incinerated is oxidized to carbon dioxide.
- Adsorption.
- A manner determined by the Director of OEPA to be not less effective than incineration and/or adsorption.

Air emissions from the air stripper are currently permitted under Ohio Air Pollution Control Regulations. Possible air emissions from excavation activities may require a permit. VOC levels in air emissions from the air stripping of groundwater from production wells W-1 and W-10 ranged up to 0.3 pounds per hour or 8 pounds per day (calculated from data in Table 1-4).

2.4 CORRECTIVE MEASURES OBJECTIVES

Based on the results of the RFI report and on consideration of identified regulatory standards, corrective measure objectives (CMOs) at the EKCO site are presented in this section.

2.4.1 Groundwater

The corrective measure objectives for groundwater at the EKCO site are to:

- Achieve regulatory standards (MCLs) for organics found in all on-site aquifers.
- Continue the prevention of migration of contamination from the site.

- Achieve regulatory standards (MCLs) for organics found in any portion of the deep sand and gravel layer (which serves the OWS wells), which is adjacent to the site and has been impacted by it.

Contaminants found above their respective MCLs were PCE, TCE, 1,1-DCE, 1,2-DCE, vinyl chloride, and 1,1,1-TCA. Action levels (MCLs) for the contaminants are:

- PCE — 0.005 mg/L
- TCE — 0.005 mg/L
- 1,1-DCE — 0.007 mg/L
- 1,2-DCE — 0.07 (cis isomer) mg/L
- Vinyl chloride — 0.002 mg/L
- 1,1,1-TCA — 0.2 mg/L

Because no isomeric breakdown analyses were performed, the cis isomer of 1,2-DCE, which has a lower MCL than the trans isomer, was used.

2.4.2 Soils

There are no promulgated cleanup levels for soils at the EKCO facility. Therefore, the CMOs are based on proposed regulatory levels and prevention of contamination of groundwater above MCLs. With regard to the potential effect of the soils on groundwater, soil cleanup goals will be calculated from a simplified modeling (discussed below) where soil/water partitioning coefficients are used to calculate soil cleanup levels based on restoring groundwater concentrations to levels below federal or state MCLs (whichever are stricter).

2.4.2.1 Organics (TCE, TCA, DCE, DCA)

Soil sampling data from the RFI indicated the presence of the primary site contaminants TCE, 1,1,1-TCA, and their breakdown products during both the 1988 and 1991 samplings. Boring locations and corresponding analytical data for TCE, 1,1,1-TCA, 1,1-DCE, 1,2-DCE, and 1,1-DCA are presented in Figures 2-1 through 2-5, respectively.

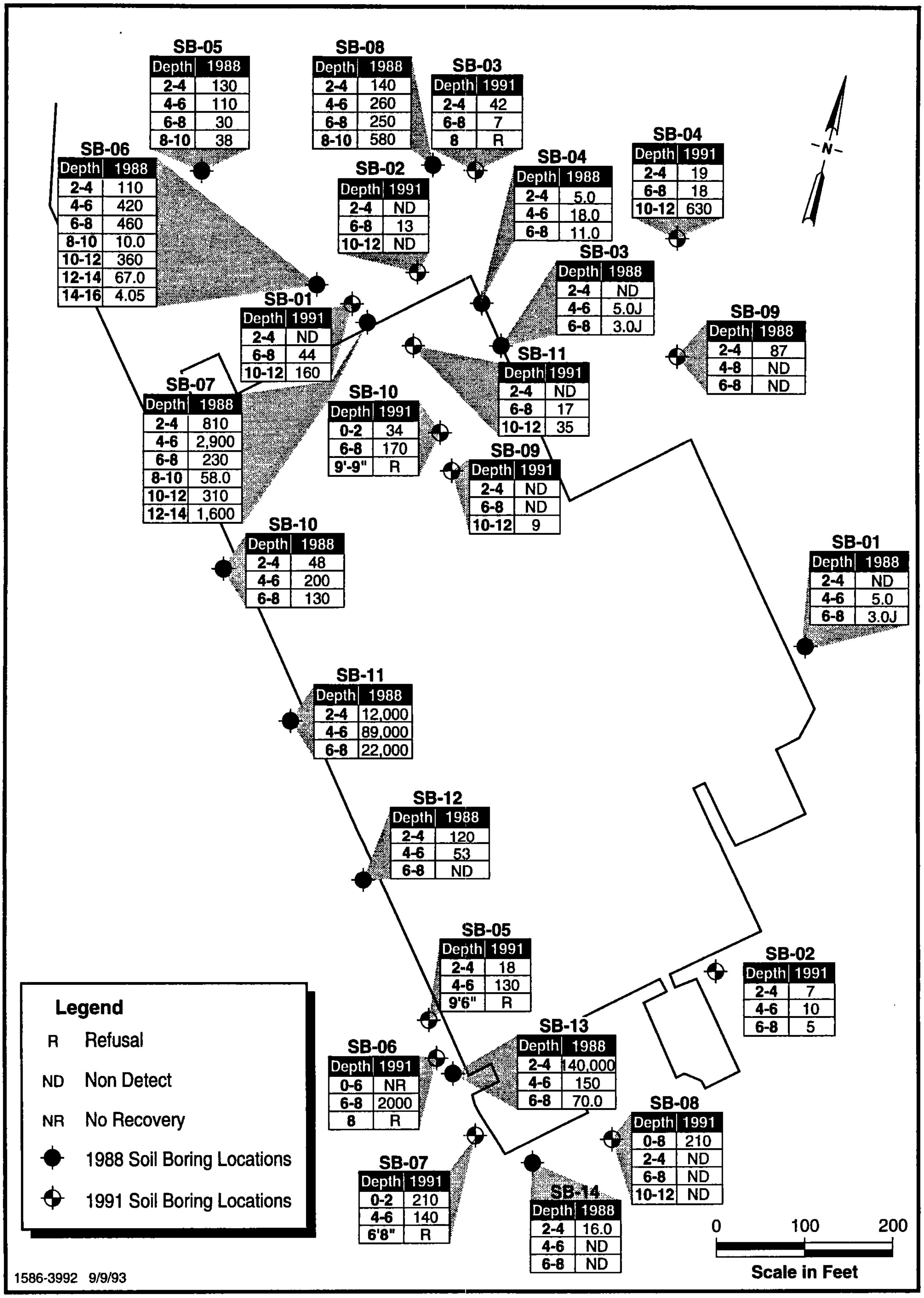

FIGURE 2-1 TRICHLOROETHENE (TCE) CONCENTRATIONS (ug/kg) IN SOIL BORING SAMPLES

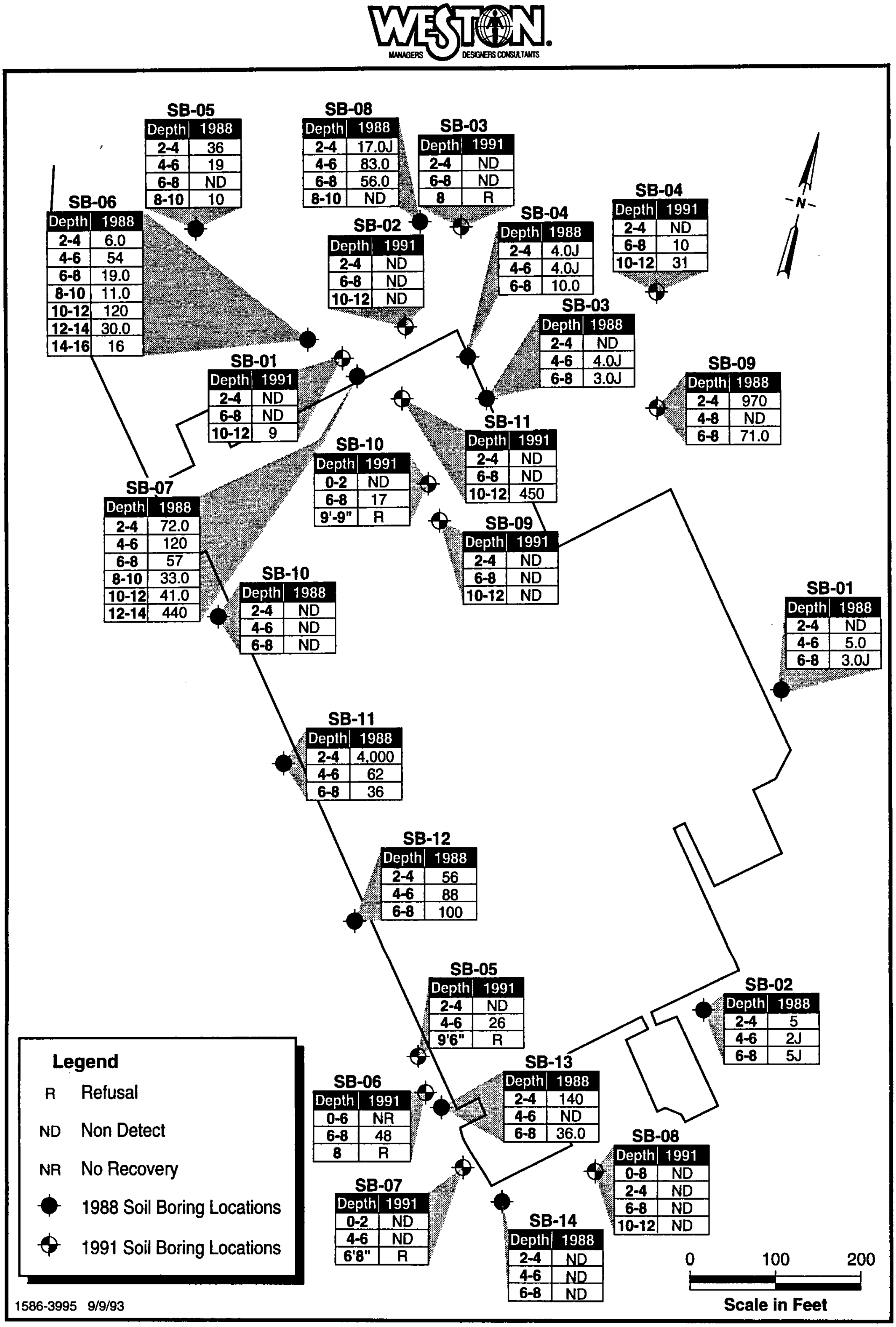

FIGURE 2-2 1,1,1 TRICHLOROETHANE (1,1,1-TCA) CONCENTRATIONS (ug/kg) IN SOIL BORING SAMPLES

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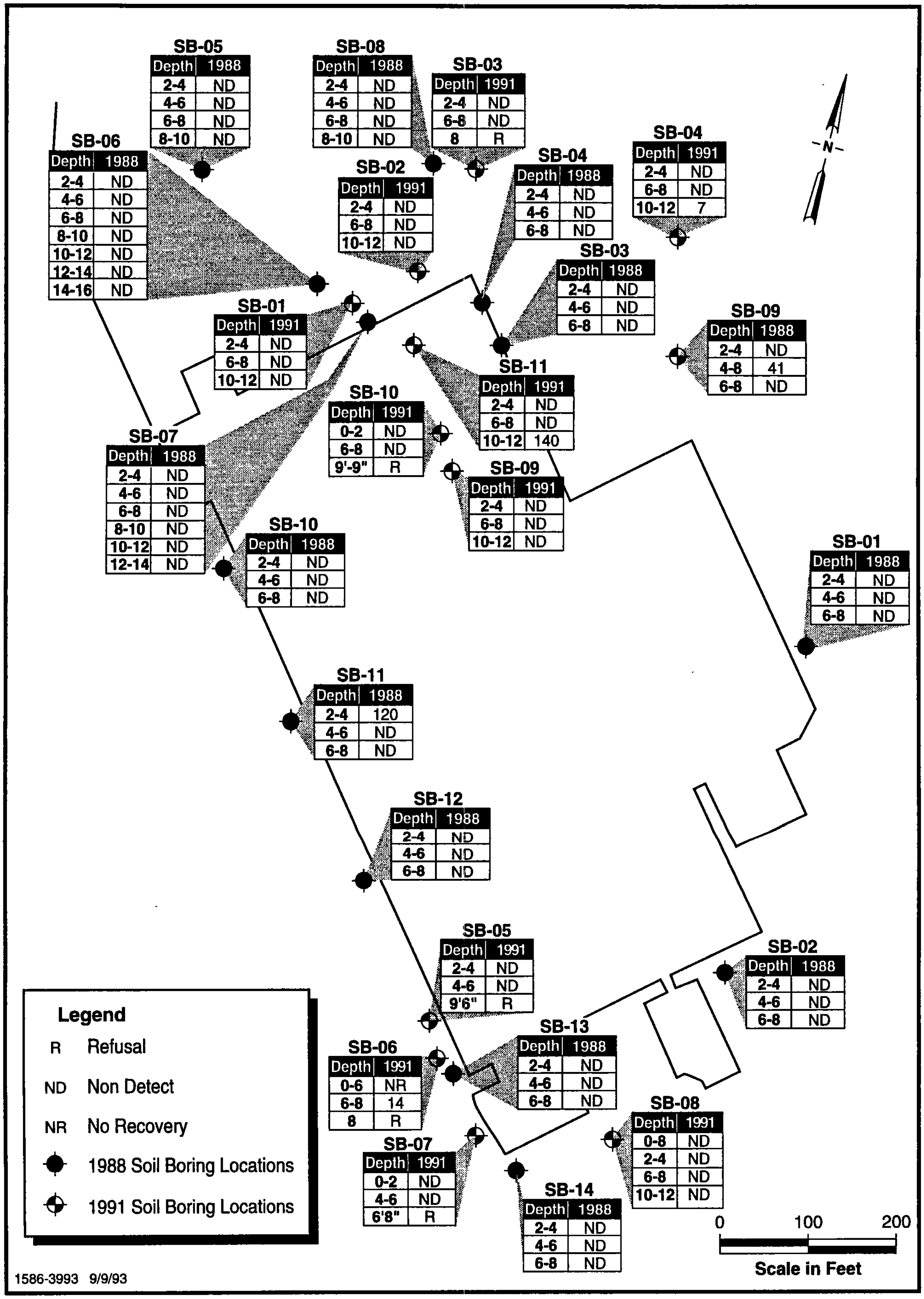

FIGURE 2-3 1,1 DICHLOROETHENE (1,1-DCE) CONCENTRATIONS (ug/kg) IN SOIL BORING SAMPLES

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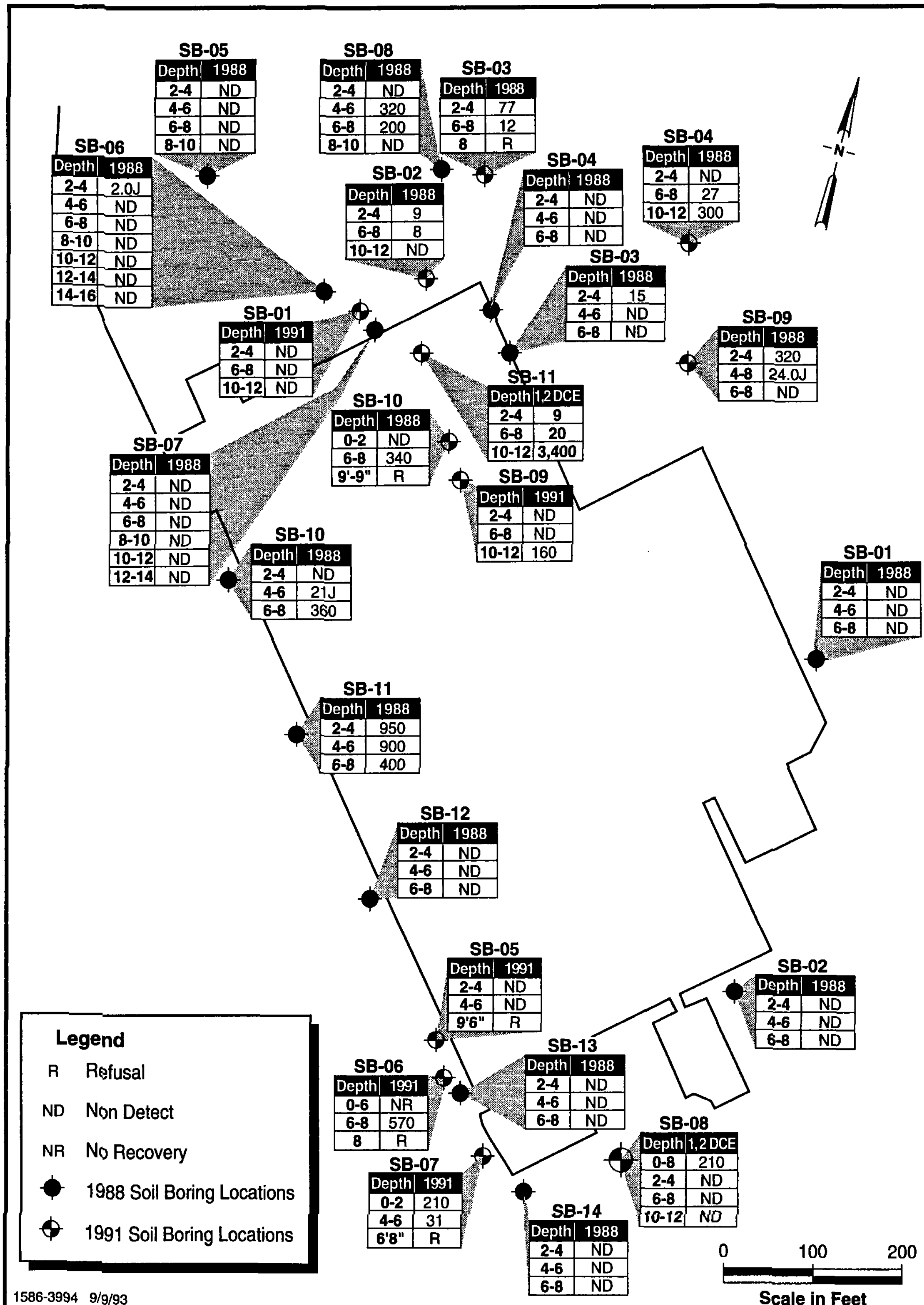

FIGURE 2-4 1,2 DICHLOROETHENE (1,2-DCE) CONCENTRATIONS (ug/kg) IN SOIL BORING SAMPLES

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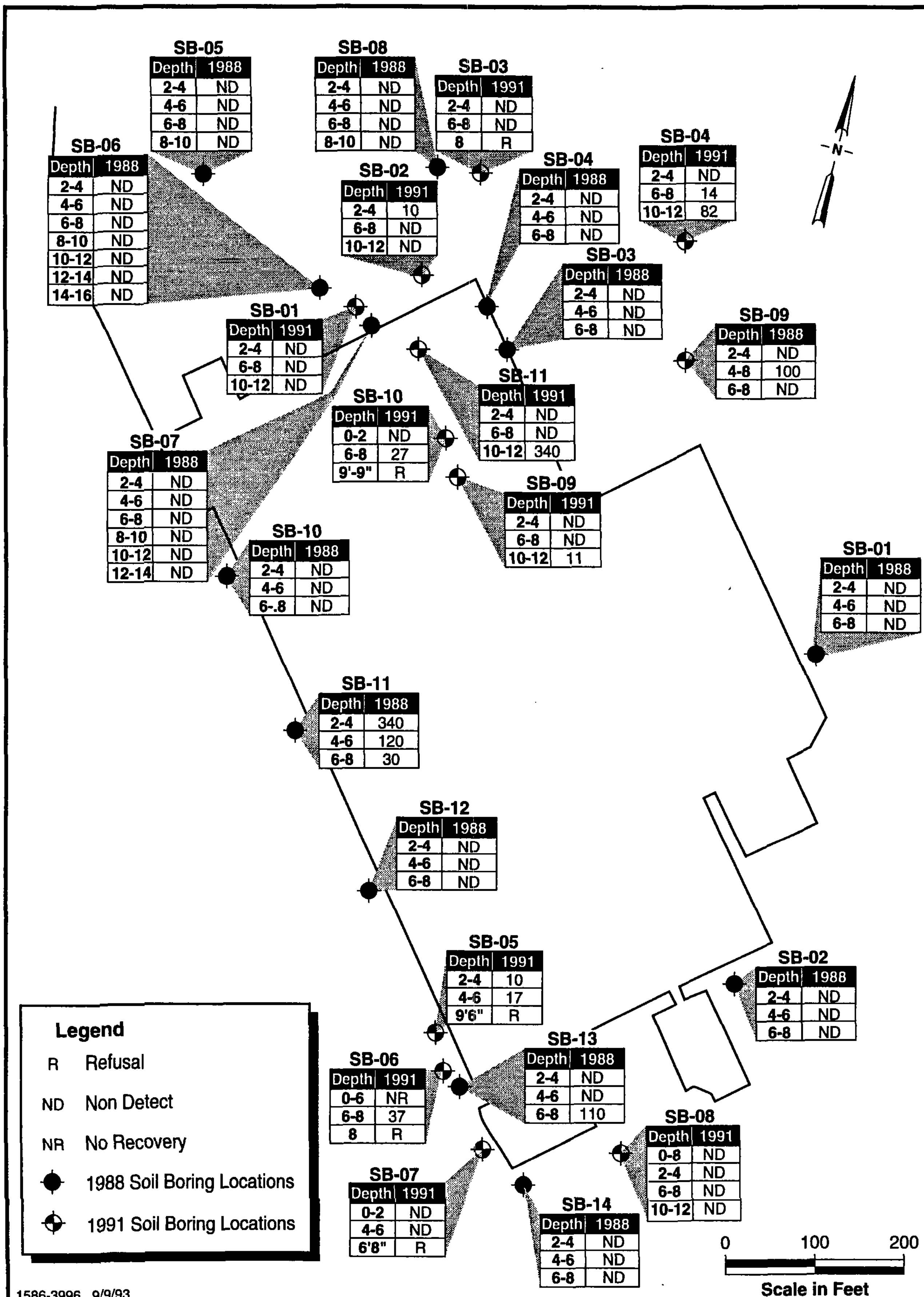

FIGURE 2-5 1,1 DICHLOROETHANE (1,1-DCA) CONCENTRATIONS (ug/kg) IN SOIL BORING SAMPLES

Levels of TCE in 1988 soil borings SB11 and SB13 (89 and 140 ppm, respectively) are above the proposed RCRA corrective action level of 60 ppm. Levels present in SB13 are highest near the surface, and drop off quickly in the next sampling interval (the drop in the surface concentration in SB13 during 1988 was confirmed by the results of 1991 soil boring SB06). Levels found in 1988 boring SB11 remained above the proposed action level to a depth of 8 ft.

2.4.2.2 Modeling

Partition modeling of contaminants found in soil borings was performed to calculate soil cleanup goals that would not cause groundwater to exceed MCLs under current pumping conditions. Modeling consisted of using the respective contaminant MCL concentration, diluted by the shallow zone aquifer volume, to determine a maximum soil concentration, based on equilibrium partitioning (K_{oc} values) between the soil and infiltrating precipitation. The infiltrated volume (approximately one-quarter of incident rainfall or about 10 inches per year) was computed using the HELP model, which can be used to evaluate infiltration through a series of vertical geological units of differing hydraulic conductivities. Dilution volumes were determined using the shallow groundwater hydrological parameters presented in the RFI under the present pumping conditions. Pertinent hydrological parameters used for dilution are the aquifer permeability K of 1 ft per day, aquifer water content of 15%, gradient under pumping conditions of 7.1%, and depth of mixing zone of 30 ft. Dilution volumes were computed along the path of groundwater flow under the contaminated areas, approximately 100 ft. Soil organic carbon content was taken as an average of 2% for soils. This dilution model is conservative as it does not consider dispersion of the contaminant before it infiltrates into the aquifer and calculates the concentration under the area of contamination instead of the concentration after mixing with the aquifer at the site boundary.

Soil cleanup goals calculated using the above method were 1.0 and 10.0 mg/kg for TCE and 1,2-DCE, respectively. These calculations are presented in Appendix B. Concentrations of TCE and 1,2-DCE found in the 1988 and 1991 soil borings exceeded these calculated soil goals. Based on these calculated cleanup levels, the areas in the vicinity of SB06 ('91)/SB-13 ('88), SB-7 ('88), and SB-11 ('88) would have to be remediated for TCE contamination. Only the area in the vicinity of SB-11 ('91) underneath the building exceeded the calculated soil goal for 1,2-DCE.

To calculate treatment volumes, the areas of contamination are estimated to be 50 ft in radius from each boring location based on adjacent soil boring concentrations (see Figure 2-6) and were assumed to end at the building perimeter. TCE contamination above the cleanup goal extends to a depth of 8 ft in the SB06/SB13 area, to a depth of 16 ft at SB-7, and to 10 ft at SB-11. Using these parameters yielded treatment volumes of approximately 31,500 ft^3 at SB06/SB13, 62,800 ft^3 at SB-7, and 39,300 ft^3 at the SB-11 location. Beneath the building 1,2-DCE contamination at SB-11 extends to a depth of 12 ft in an approximately circular area, resulting in an excavation volume of 94,200 ft^3. A summary of the estimated treatment volumes is presented in Table 2-5.

2.4.2.3 Metals (Cadmium, Chromium, and Lead)

The only identified source of metals contamination at the facility is the lagoon area, which will undergo clean closure (as approved by OEPA in July 1993) as described in the *RCRA Closure Plan for EKCO Housewares, Inc., Massillon, Ohio* (December 1992). Therefore, there are no corrective measure objectives required for metals concentrations in soils.

2.4.2.4 Summary of Contaminants of Concern

In summary, the contaminants of concern in soils at EKCO are TCE and 1,2-DCE. TCE exceeds both the proposed RCRA action level and the groundwater transport model soil cleanup goal. 1,2-DCE exceeds the soil cleanup goal for protection of groundwater calculated using the groundwater transport model.

Table 2-5 is a summary of the action levels (mg/kg), locations, and estimated excavation volumes for the contaminants of concern in soils at EKCO. The locations are shown in Figure 2-6.

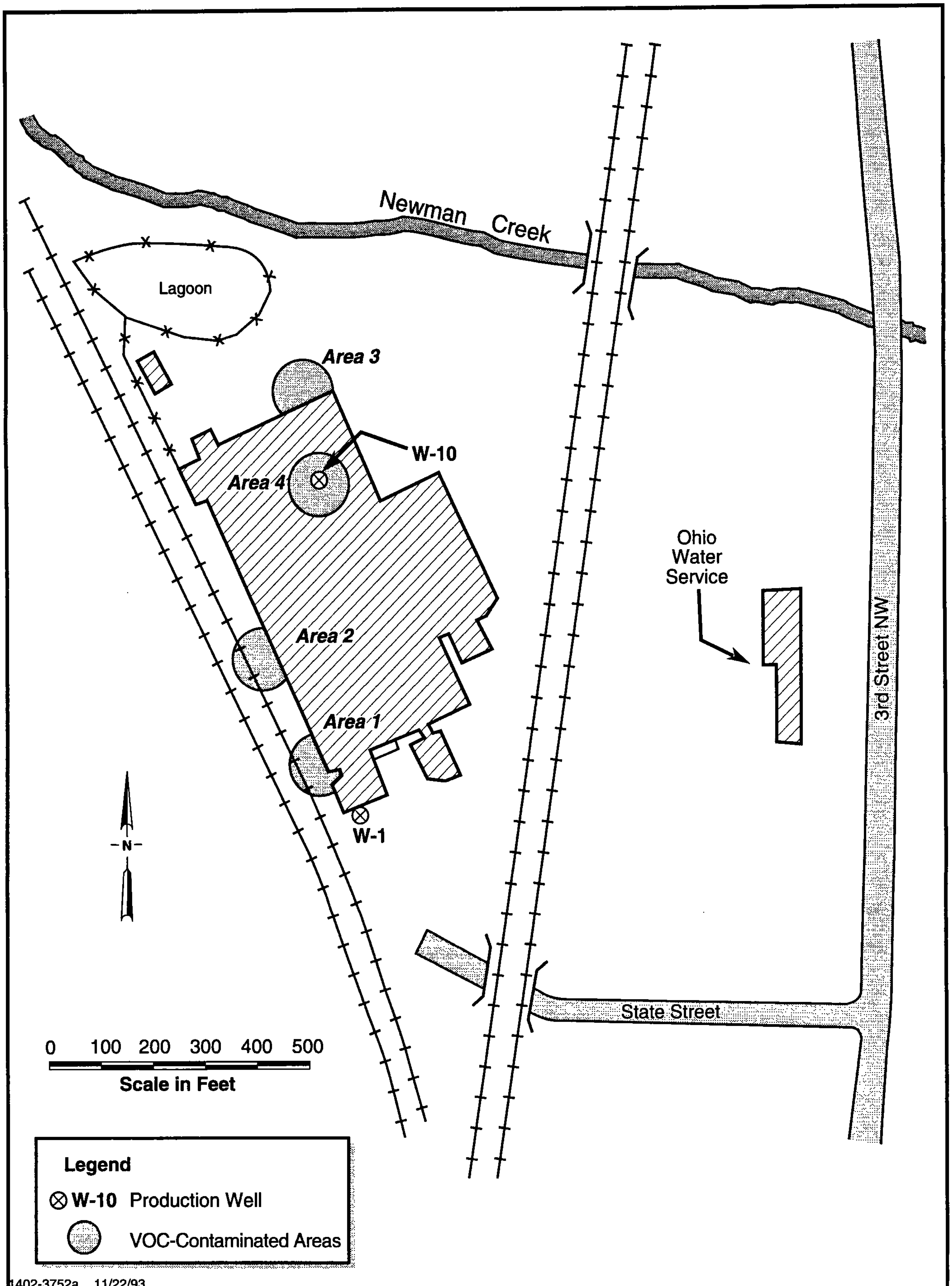

FIGURE 2-6 VOC-CONTAMINATED AREAS EXCEEDING SOIL CLEANUP GOALS

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Table 2-5

Action Levels and Estimated Volumes for Contaminants in Soils

Groundwater Contaminant	Proposed RCRA Cleanup Level (mg/kg)	Cleanup Level Developed from the Transport Model (mg/kg)	Locations	Volumes
TCE	60	1	Area 1: SB06 ('91)/SB-13 ('88)	31,400 ft^3 (1,160 yd^3)
			Area 2: SB-7 ('88)	62,800 ft^3 (2,330 yd^3)
			Area 3: SB-11 ('88)	39,300 ft^3 (1,460 yd^3)
1,2-DCE	–	10	Area 4: SB-11 ('91)	94,200 ft^3 (3,490 yd^3)

SECTION 4
REMEDIAL ACTION ALTERNATIVES

4.1 DEVELOPMENT OF REMEDIAL ALTERNATIVES

Remedial action alternatives have been developed for the cleanup of the EKCO facility. These alternatives are based on the technologies retained in the screening process detailed in Section 3. Technologies that are complementary and/or interrelated were combined into alternatives. Groundwater alternatives and source corrective alternatives are discussed below.

4.2 GROUNDWATER ALTERNATIVES DEVELOPED FOR EVALUATION

Groundwater in the shallow, intermediate, and bedrock water-bearing zones at the EKCO facility is currently contained on-site by the interim remedial measures (IRM) pumping of bedrock wells W-1 and W-10. The containment of the shallow and intermediate zones is apparently a result, in part, of leakage caused by improper sealing of the R-wells. Implementation of the proposed well rehabilitation IRM, discussed in Subsection 1.4.4, will eliminate this pathway. At this time, it is impossible to fully predict the effect of this IRM. To the degree that the shallow and intermediate zones are still hydraulically connected to the deep zone, the pumping from the deep recovery wells will still retard or prevent flow of the upper zones. The alternatives were developed based on the conservative assumption that essentially all hydraulic control in the shallow and intermediate zones would be lost as a result of the well rehabilitation. That is, after the IRM, the current recovery wells may not prevent off-site migration of groundwater in the upper zones.

The following groundwater remedial technologies were retained during the screening process:

- No action.
- Groundwater monitoring.
- Well permit restrictions.

- Pumping wells.
- Vertical barriers.
- Air stripping.
- Activated carbon.

Two institutional groundwater control methods, groundwater monitoring and well permit restrictions, were retained for further consideration in conjunction with groundwater recovery technologies during the screening process. Groundwater monitoring may consist of two actions: periodic water level measurements to ensure adequate capture of contaminated groundwater, and chemical analysis of groundwater samples to monitor the level of contamination in the groundwater. Restrictions on groundwater use in the vicinity of the facility would be needed to ensure hydraulic control of site groundwater.

Two groundwater containment technologies were retained during the screening process, recovery wells and vertical containment controls. Based on the conservative assumptions of the projected outcome of the well rehabilitation IRM, some level of groundwater recovery from the shallow and intermediate water-bearing zones would be necessary. The use of a slurry wall was considered to reduce the volume of water that would require recovery from the shallow and intermediate water-bearing zones. It was estimated that a slurry wall could reduce the required volume of recovered water from the shallow and intermediate zones from approximately 50 gpm to 25 gpm. Therefore, this alternative would still require the use of groundwater recovery wells.

The cost of installation of the slurry wall alone is approximately $4 million. Both approaches—recovery wells or a combination of a slurry wall and recovery wells—would serve to prevent the off-site migration of groundwater from the shallow and intermediate water-bearing zones. A slurry wall may not reduce the number of recovery wells required for the shallow and intermediate zones. It would serve only to slightly reduce the capital and operating and maintenance costs for groundwater recovery in these zones. Based on this preliminary cost estimate, it is apparent that the alternative of slurry wall and recovery wells would not be cost-effective. Therefore, the slurry wall alternative was not retained for further development.

Two groundwater treatment technologies were retained during the screening process: air stripping and granular activated carbon adsorption. An air stripping system is currently used to treat groundwater recovered from the site. No alternative for groundwater recovery under these circumstances would necessitate the expansion or modification of the existing treatment system. Granular activated carbon (GAC) offers no advantage over the existing system and would have higher operating costs. In this scenario, air stripping using the existing permitted air stripper is considered the most cost-effective approach for treatment. Therefore, the GAC alternative was not evaluated.

During the RFI, following an extended shutdown of recovery well W-1, it was noticed that the level of VOCs in the recovered groundwater increased dramatically in the next sampling event. VOCs at W-1 increased from 256 μg/L prior to the shutdown to 4,726 μg/L following the shutdown. Based on this finding, pulse pumping of the W-wells was considered as a potential remedial approach that could serve to reduce the overall time frame necessary to remediate the groundwater at the facility.

The alternatives developed based on these technologies are discussed below:

- Alternative GW-1: No action - With the no action alternative, the current groundwater recovery operation would cease. Site groundwater would be uncontrolled. No groundwater monitoring would be performed.

- Alternative GW-2: Installation of additional recovery wells - Operation of the existing recovery wells, W-1 and W-10, would continue. An additional two recovery wells would be used to control groundwater in the shallow and intermediate water-bearing zones. The existing air stripper will be used to treat the recovered groundwater. Groundwater monitoring would be continued on a semi-annual basis. Wells not required for monitoring would be grouted/sealed.

- Alternative GW-3: Installation of additional recovery wells and pulse pumping of bedrock wells - Three additional recovery wells would be used to control groundwater in the shallow and intermediate water-bearing zones. Operation of the existing recovery system would be modified so that each of the recovery wells, W-1 and W-10, would be operated on an alternating (pulsed) basis. The average flowrate of the system would be reduced, and higher VOC removal rates are predicted. The object would be to increase the overall mass flow rate (i.e., pounds per year) of VOCs removed. The existing air stripper will be used to treat the recovered groundwater. Groundwater monitoring would be performed on a semi-annual basis. Wells not required for groundwater monitoring would be grouted/sealed.

These groundwater alternatives will be evaluated in Subsection 5.3.

4.3 SOURCE-CORRECTIVE ALTERNATIVES FOR SOILS UNDERNEATH THE BUILDING DEVELOPED FOR EVALUATION

It is estimated that 3,500 yd^3 of soils underneath the building are contaminated. As noted in Section 1, the building contains an active production facility. Therefore, excavation is not feasible, and only in situ technologies would be appropriate for remediation of the soils underneath the building. The following technologies were retained during the screening process:

- No action.
- Vertical SVE treatment.
- Horizontal SVE treatment.

The alternatives developed based on these technologies are discussed below:

- Alternative IS-1 - No action — Under this alternative, no remedial action would be performed on the soils underneath the building.

- Alternative IS-2 - SVE treatment — Under this alternative, an SVE system would be installed to remove VOCs from the soils underneath the building. Air injection vents and vertical recovery vents would be installed through the floor of the building. The removed VOCs would be treated using granular activated carbon, if necessary. A pilot system would be installed and additional soil borings would be completed in the area to define the placement of vents for a full-scale system.

- Alternative IS-3 - Horizontal SVE treatment — Under this alternative, an SVE system would be installed to remove VOCs from the soils underneath the building. Air injection vents and recovery vents would be installed from outside of the building and run horizontally underneath the building. The removed VOCs would be treated using granular activated carbon, if necessary.

A pilot system would be installed and additional soil borings would be completed in the area to define the placement of vents for a full-scale system.

4.4 SOURCE-CORRECTIVE ALTERNATIVES FOR SOILS OUTSIDE THE BUILDING DEVELOPED FOR EVALUATION

Three areas of soil contamination outside the building exceed the soil action levels developed in Section 2. It is estimated that 4,900 yd^3 of soil outside the building area are contaminated. Both in situ and ex situ technologies would be appropriate for remediation of soils outside the building. The following technologies were retained during the screening process:

- No action.
- Fence and post warning signs.
- SVE.
- Excavation.
- Ex situ volatilization.
- Low temperature thermal treatment.
- Off-site incineration.
- Off-site landfill.

The alternatives developed based on these technologies are discussed below:

- Alternative OS-1 - No action — Under this alternative, no remedial action would be performed on the soils outside the building.
- Alternative OS-2 - Fence and post warning signs — Under this alternative, areas outside the building that have soil contamination exceeding the proposed RCRA corrective action guidelines would be fenced and posted to prevent unauthorized contact.
- Alternative OS-3 - SVE — Under this alternative, an SVE system would be installed to remove VOCs from the three areas of soil contamination outside the building. Air injection vents and a combination of vertical and horizontal recovery vents would be installed in each area. The removed VOCs would be treated using granular activated carbon, if necessary. A pilot system would be installed and additional soil borings would be completed in the area to refine the placement of vents for a full-scale system.

- Alternative OS-4 - Ex situ volatilization — Under this alternative, the three areas of soil contamination outside the building would be excavated. This soil would be placed on an impervious surface for treatment. The VOCs would be removed through a series of pipes connected to a vacuum pump. The removed VOCs would be treated using granular activated carbon, if necessary. Following successful treatment, the soil would be returned to the excavation. Implementation of this approach would require the designation of a CAMU at the facility.

- Alternative OS-5 - Low temperature thermal treatment — Under this alternative, the three areas of soil contamination outside the building would be excavated. This soil would be pretreated to remove any large debris. The soil would then be conveyed into the thermal treatment unit. The removed VOCs would be treated using granular activated carbon. Following successful treatment, the soil would be returned to the excavation. Implementation of this approach would require the designation of a CAMU at the facility.

- Alternative OS-6 - Off-site disposal/incineration — Under this alternative, the three areas of soil contamination outside the building would be excavated. This soil would be sent to either a hazardous waste landfill or incinerator, depending on whether the excavated soil met the LDRs.

SECTION 5

DETAILED ANALYSIS OF CORRECTIVE MEASURE ALTERNATIVES

5.1 INTRODUCTION

This section presents the detailed analysis of the corrective measure alternatives developed in Section 4 to address the contaminated soils and groundwater at the EKCO site. Each alternative is analyzed in detail for technical applicability and cost, and is qualitatively evaluated for environmental, human health, and institutional considerations as detailed in the RFI/CMS Work Plan.

5.2 ANALYSIS CRITERIA

Each of the developed alternatives is evaluated based on the following criteria: technical, environmental, human health, institutional, and cost. These criteria are discussed below.

5.2.1 Technical Criteria

The technical evaluation criteria include performance, reliability, implementability, and safety.

Performance will be evaluated based on the effectiveness and useful life of the corrective measure technology as follows:

- Effectiveness will be evaluated in terms of the ability to perform intended functions, such as containment, diversion, removal, destruction, or treatment. The effectiveness of each corrective measure will be determined either through design specifications or by performance evaluation. Any specific waste or site characteristic that could potentially impede effectiveness will be considered. The evaluation will also consider the effectiveness of combinations of technologies.

- Useful life is defined as the length of time the level of effectiveness can be maintained. Corrective measures technologies, with the exception of destruction technologies, may potentially show deteriorating performance with time. Often, deterioration can be slowed through proper system operation and maintenance, but the technology eventually may require replacement. Each corrective measure alternative will be evaluated in terms of the projected service lives of its component technologies, as well as appropriateness of the technologies.

5.2.2 Environmental Criteria

An environmental assessment (EA) of each alternative will focus on the environmental conditions and pathways of contaminant migration actually addressed by the alternative. The EA for each alternative will include an evaluation of the short- and long-term beneficial and adverse effects on environmentally sensitive areas and an analysis of measures to mitigate adverse effects.

5.2.3 Human Health Criteria

Each alternative will be assessed in terms of the extent to which it mitigates short- and long-term potential human exposure to any residual contamination and how it protects human health both during and after implementation of the corrective measure. The assessment will consider the levels and characterizations of contaminants on-site, potential exposure routes, and the potentially affected population. Each alternative will be evaluated to determine the level and the reduction over time of exposure to contaminants. For management of mitigation measures, the relative reduction of impact will be determined by comparing residual levels of each alternative with existing criteria and standards.

5.2.4 Institutional Criteria

Relevant institutional needs or limitations for each alternative will be assessed. Specifically, the effects of federal, state, and local environmental and public health statutes, standards, regulations, final guidance, or ordinances will be considered.

5.2.5 Cost

The estimated cost for each viable corrective measure alternative will be evaluated in comparison to other alternatives that achieve the performance criterion associated with the corrective measure objectives. In considering the cost of the various alternatives, the following categories are evaluated:

- Capital costs — These costs include expenditures for equipment, labor, and materials necessary to construct corrective measure systems. Also included are engineering design, site preparation, construction supervision, quality assurance, and administrative costs.

- Operating and maintenance costs — These are post-construction costs incurred to ensure effective implementation of the alternative. Such costs may include, but are not limited to, operating labor, maintenance materials and labor, monitoring costs (sampling labor, laboratory analyses, and report preparation), periodic disposal of residues, utilities, and administrative, insurance, and licensing costs.

5.3 DETAILED ANALYSIS OF GROUNDWATER ALTERNATIVES

Groundwater alternatives were evaluated based on the corrective measures objectives developed in Subsection 2.4.1. The following alternatives were developed:

- GW-1: No Action.

- GW-2: Use of Additional Overburden Recovery Wells and Constant Pumping of Wells W-1 and W-10.

- GW-3: Use of Additional Overburden Recovery Wells and Pulse-Pumping of Wells W-1 and W-10.

The alternatives are discussed in the following subsections.

5.3.1 Alternative GW-1: No Action

The no-action alternative for groundwater at EKCO provides a basis for comparing existing site conditions with those resulting from implementation of the other proposed alternatives. Under the no-action alternative, no additional measures will be used to remediate the contaminant source or any potential migration pathways, and the existing pump-and-treat system would be turned off. VOC contamination would not be reduced in this no-action scenario, except through natural degradation processes, and would be expected to migrate off-site.

5.3.1.1 Technical Evaluation

Because no actions are implemented under this alternative, there is no technical evaluation of performance or reliability. The ability of the groundwater to meet objectives under this alternative would take decades at best through natural degradation. This alternative could be readily implemented by discontinuing the current pump-and-treat activities. No operational or maintenance controls are necessary, and this alternative can be safely implemented.

5.3.1.2 Environmental Assessment

Implementation of the no-action alternative will have a negative effect on the environment. Contaminant reduction over time would be slow while on-site contaminants would migrate off-site and possibly discharge to Newman Creek. Discontinuance of the pump-and-treat system would eliminate discharges to the air through the air stripper.

5.3.1.3 Human Health

Implementation of the no-action alternative may have a negative effect on human health. Contaminant reduction in the groundwater would be slow while contaminants would migrate off-site. Implementation would not have any additional adverse affects, and air emissions from the air stripper would be eliminated. This alternative would not be protective of groundwater.

5.3.1.4 Institutional

The no-action alternative would be difficult to implement because there are current laws (MCLs) requiring action for particular contaminants at various concentrations in groundwater. Concentrations of several contaminants at EKCO are above these MCLs. Remediation of the groundwater may be required by either the state or federal EPA for PCE, TCE, 1,1-DCE, 1,2-DCE, vinyl chloride, and 1,2-DCA concentrations that are above their respective MCLs.

5.3.1.5 Cost Estimate

No costs would be incurred under the no-action alternative.

5.3.2 Alternative GW-2: Use of Additional Overburden Recovery Wells and Constant Pumping of Wells W-1 and W-10

Under this alternative, contaminated bedrock groundwater will be recovered using wells W-1 and W-10 at the current pumping rates. Pumping of these wells will be sufficient to prevent off-site migration of contaminated bedrock groundwater. After the well rehabilitation IRM is implemented (for R-1, R-2, R-3, W-1, and W-10, as discussed in Subsection 1.4.4), it is possible that the W-wells may no longer recover all of the contaminated groundwater from the shallow and intermediate water-bearing zones. It is projected that the recovery rate from the bedrock wells, therefore, could be reduced.

If this is the case, either two additional overburden recovery wells will be installed or existing monitor wells will be converted to recovery wells for control of the shallow and intermediate water-bearing zones. The location of these recovery wells would be finalized after the well rehabilitation IRM is completed. Successive rounds of water level data would be collected and incorporated into a groundwater flow model. Based on the results of this flow model, the location and pumping rate of recovery wells for the shallow and intermediate water-bearing zones would be determined.

Alternative GW-2, for purposes of the CMS, has been analyzed based on the following approach:

- The existing wells I-2 and L-1, as shown in Figure 5-1, would be converted into recovery wells. The discharge from these two wells would be directed to the existing air stripper. Each well would be equipped with a ½-hp submersible pump and pumped at an approximate rate of 5 to 25 gpm. Flow meters would be installed at each well.
- Operation of the air stripper would continue without modification.
- The following parameters will be monitored for the four recovery wells:
  - Water level.
  - Pumping rate.
  - Volume treated.
  - VOC levels.
- Monitoring of the treatment system performance would continue on a monthly basis. The following parameters would be monitored:
  - Pumping rate.
  - Volume treated.
  - VOC levels at air stripper discharge.
  - VOC levels at Outfall No. 001.
- Monitoring of VOC levels in selected perimeter wells would continue. Specific wells will be selected to monitor VOC levels at the site boundary in the shallow, intermediate, and bedrock water-bearing zones.

The final component of this alternative is the placement of restrictions on groundwater use in the area. This plan would require the cooperation of local property owners, the City of Massillon, and OEPA. The proposed groundwater recovery system is expected to be sufficient to contain contaminated groundwater in the shallow, intermediate, and bedrock water-bearing zones under the current off-site pumping conditions. If an adjacent facility were to install a production or recovery well in one of these units, it is possible that such a well could draw contamination from the EKCO facility. It is difficult to project the extent

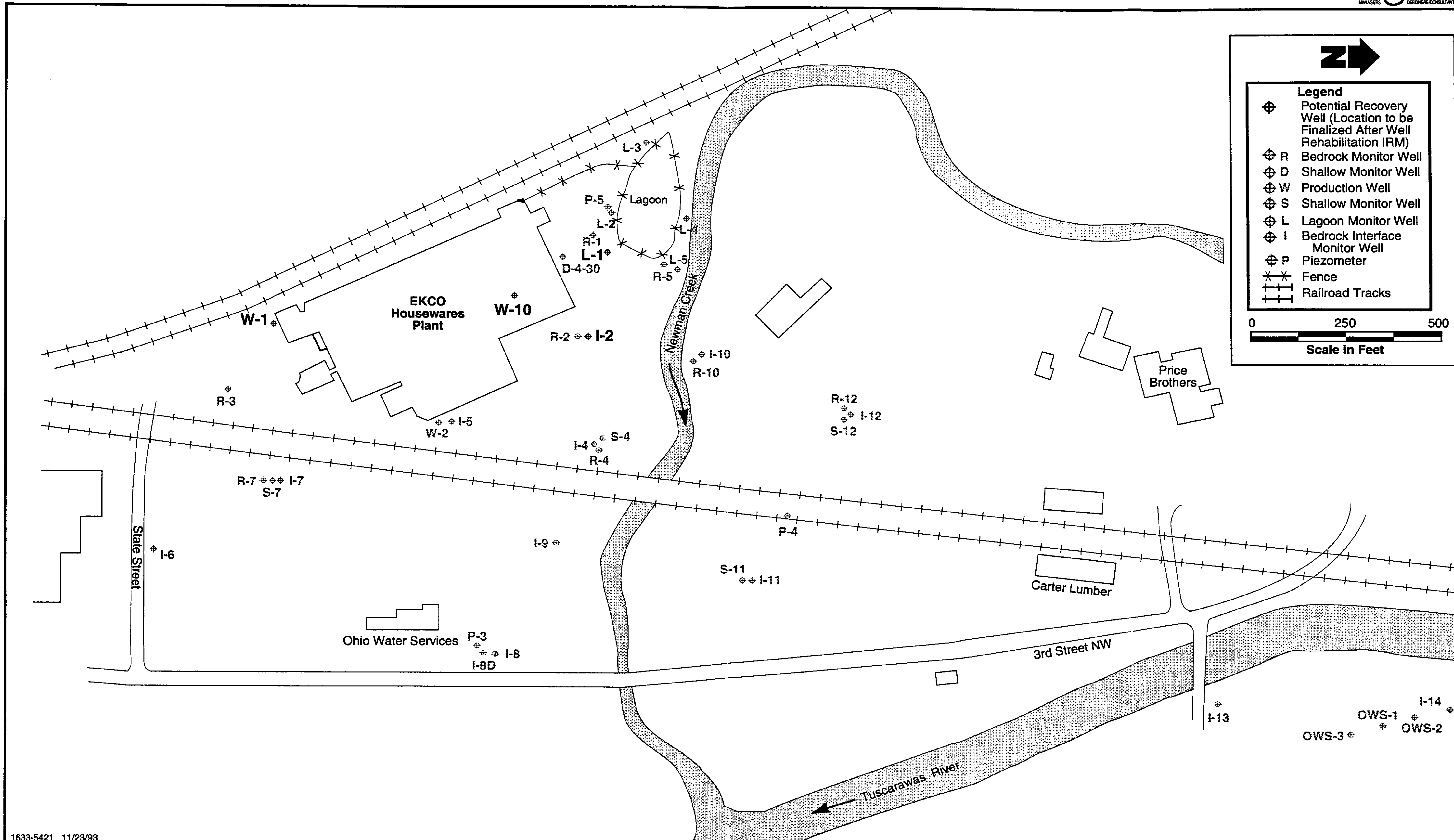

FIGURE 5-1 ALTERNATIVE GROUNDWATER - 2 RECOVERY WELL LOCATION MAP

of the required well restrictions at this time. The areas will be delineated following the well rehabilitation IRM.

5.3.2.1 Technical Evaluation

Monitoring will be used to evaluate the groundwater recovery system and to verify its effectiveness in migration control and aquifer restoration. The well rehabilitation IRM should eliminate two major existing sources of bedrock contamination.

It is expected that periodic maintenance and replacement of the groundwater recovery pumps will be necessary. The tower packing may need replacement every 5 years (based on currently available operating data). The recovery wells may need to be rehabilitated every 10 years. It is expected that pumps and the air blower would also require periodic replacement. The existing groundwater recovery and treatment system has operated reliably since 1986. The modifications proposed in this alternative should not affect the level of reliability of the current system.

This alternative calls for the conversion of two existing monitoring wells (I-2 and L-1) to recovery wells and subsequent connection to the existing treatment system. The necessary pumps and piping are items that are readily available. Implementation of these changes would require some trenching for the pipe installation. These changes could be readily implemented within a short period of time. Minor permit modifications may be necessary.

Workers installing the pumps and the piping would have to wear proper protective clothing to avoid direct contact with VOC-contaminated groundwater and soils. These activities would have no effect on the community.

5.3.2.2 Environmental Evaluation

This alternative will prevent the off-site migration of contaminated groundwater. VOCs in the recovered groundwater will be treated using the existing permitted air stripper. The treated groundwater will be discharged through Outfall No. 001 in accordance with the facility's NPDES permit. No adverse effects on the air or the surface water are expected. The groundwater pump and treat system will be operated until target levels are reached. At this time, it is not possible to accurately predict the duration of groundwater recovery that may be needed.

5.3.2.3 Human Health Evaluation

The deep water-bearing zone is currently being used as a source for public drinking water by OWS. OWS currently operates three wells that are located 2,000 ft northeast of the EKCO facility. This alternative will prevent the migration of contamination from the EKCO facility to these wells. The well restriction program will also prevent the unauthorized use of groundwater that could draw contamination off-site.

5.3.2.4 Institutional Evaluation

Implementation of the well restriction program to prevent potential off-site migration of VOC-contaminated groundwater will require the cooperation of the City of Massillon and OEPA. The owners of the affected properties may legally oppose such an action.

5.3.2.5 Cost Evaluation

Capital costs for this alternative include pumps for the additional recovery wells, piping from the wells to the air stripper, and the implementation of a well restriction program. Table 5-1 presents the estimated order-of-magnitude capital costs for this option. The total capital cost of this alternative is estimated to be $99,000. Operating and maintenance costs include labor, utilities, and monitoring of the system performance and the groundwater. Table 5-2 presents order-of-magnitude operating and maintenance costs for this alternative. The total yearly operating and maintenance costs are $147,000.

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Table 5-1

Estimated Order-of-Magnitude Capital Costs for Alternative GW-2 (Use of Additional Overburden Recovery Wells and Constant Pumping of Wells, W-1 and W-10)

Item	Description	Quantity	Unit Cost ($)	Total Cost ($)
1	Groundwater Model Development	Lump Sum	35,000	35,000
2	Installation of Well Pumps and Controls	2	3,000	6,000
3	New Recovery Well Pumping Tests	Lump Sum	15,000	15,000
4	Installation of Piping and Conduit	500 ft	20/ft	10,000
5	Tie into Existing System	2	500	1,000
	Subtotal			67,000
6	Administrative (22%)			14,700
7	Contingency (25%)			16,800
	Total			99,000

Table 5-2

Estimated Order-of-Magnitude Operating and Maintenance Costs for Alternative GW-2 (Use of Additional Overburden Recovery Wells and Constant Pumping of Wells W-1 and W-10)

Item	Description	Quantity	Unit Cost ($)	Total Cost/ Year ($)*
1	Labor	Lump Sum	25,000	25,000
2	Analytical	Lump Sum	35,000	35,000
3	Maintenance	Lump Sum	4,000	4,000
4	Utilities	Lump Sum	36,000	36,000
	Subtotal			100,000
5	Administrative (22%)			22,000
6	Contingency (25%)			25,000
	Total			147,000

*Years 1 through 30.

5.3.3 Alternative GW-3: Use of Additional Overburden Recovery Wells and Pulse-Pumping of W-1 and W-10

Under this alternative, contaminated bedrock groundwater will be recovered using wells W-1 and W-10. Pumping of these wells will be sufficient to prevent off-site migration of contaminated bedrock groundwater. After the well rehabilitation IRM is implemented, it is expected or possible that the W-wells may no longer recover all of the contaminated groundwater from the shallow and intermediate water-bearing zones. Under this alternative, water will not be pumped continuously from W-1 and W-10; rather, these wells will be operated intermittently, or pulsed. Pulse-pumping of wells W-1 and W-10 will reduce the volume of water recovered from the bedrock water-bearing zone. It may also serve to increase the concentration of VOCs in the recovered groundwater. Operation of the wells will be phased so that when one W-well is pumped, the other is on standby. The frequency of switching would be determined during a treatability and modeling study that would be performed following the well rehabilitation IRM.

For this alternative, either three additional overburden recovery wells will be installed or existing monitor wells will be converted to recovery wells for control of the shallow and intermediate water-bearing zones. Following the well rehabilitation IRM, successive rounds of water level data will be collected and incorporated into a groundwater flow model. Based on the results of this flow model, the location and pumping rate of recovery wells for the shallow and intermediate water-bearing zones will be finalized.

Alternative GW-3, for the purposes of the CMS, has been analyzed based on the following approach:

- The existing wells, I-2, L-1, and I-5, as shown in Figure 5-2, would be converted into recovery wells. These three wells would be connected to the existing air stripper. Each well would be pumped at an approximate rate of 5 to 25 gpm. Flow meters would be installed at each well.

- Operation of the air stripper would continue without modification.
- The following parameters will be monitored for the five recovery wells:

- Water level.
- Pumping rate.
- Volume treated.

- Monitoring of the treatment system parameters would continue. In addition, the following treatment system parameters will be monitored:
  - Pumping rate.
  - Volume treated.
  - VOC levels in the air stripper discharge.
  - VOC levels at Outfall No. 001.

- Monitoring of VOC levels in selected perimeter wells will continue.

The final component of this alternative is the placement of restrictions on groundwater in the area. This plan would require the cooperation of local property owners, the City of Massillon, and OEPA. The proposed groundwater recovery system is expected to be sufficient to contain contaminated groundwater in the shallow, intermediate, and bedrock water-bearing zones under the current off-site pumping conditions. If an adjacent facility were to install a production or recovery well in one of these units, it is possible that such a well could draw contamination from the EKCO facility. Given the uncertainty of the effect of the well rehabilitation IRM, it is difficult to project the scope of needed well restrictions at this time. These areas will be delineated following the well rehabilitation IRM.

5.3.3.1 Technical Evaluation

Monitoring will be used to evaluate the groundwater recovery system and to verify its effectiveness in migration control and aquifer restoration. During testing of this alternative, water level measurements would be recorded to ensure that hydraulic control of the bedrock is maintained. Samples would be collected from W-1 and W-10 to monitor the effect of pulse-pumping on VOC levels.

It is expected that periodic maintenance and replacement of the groundwater recovery pumps will be necessary. The tower packing may need replacement every 5 years (based

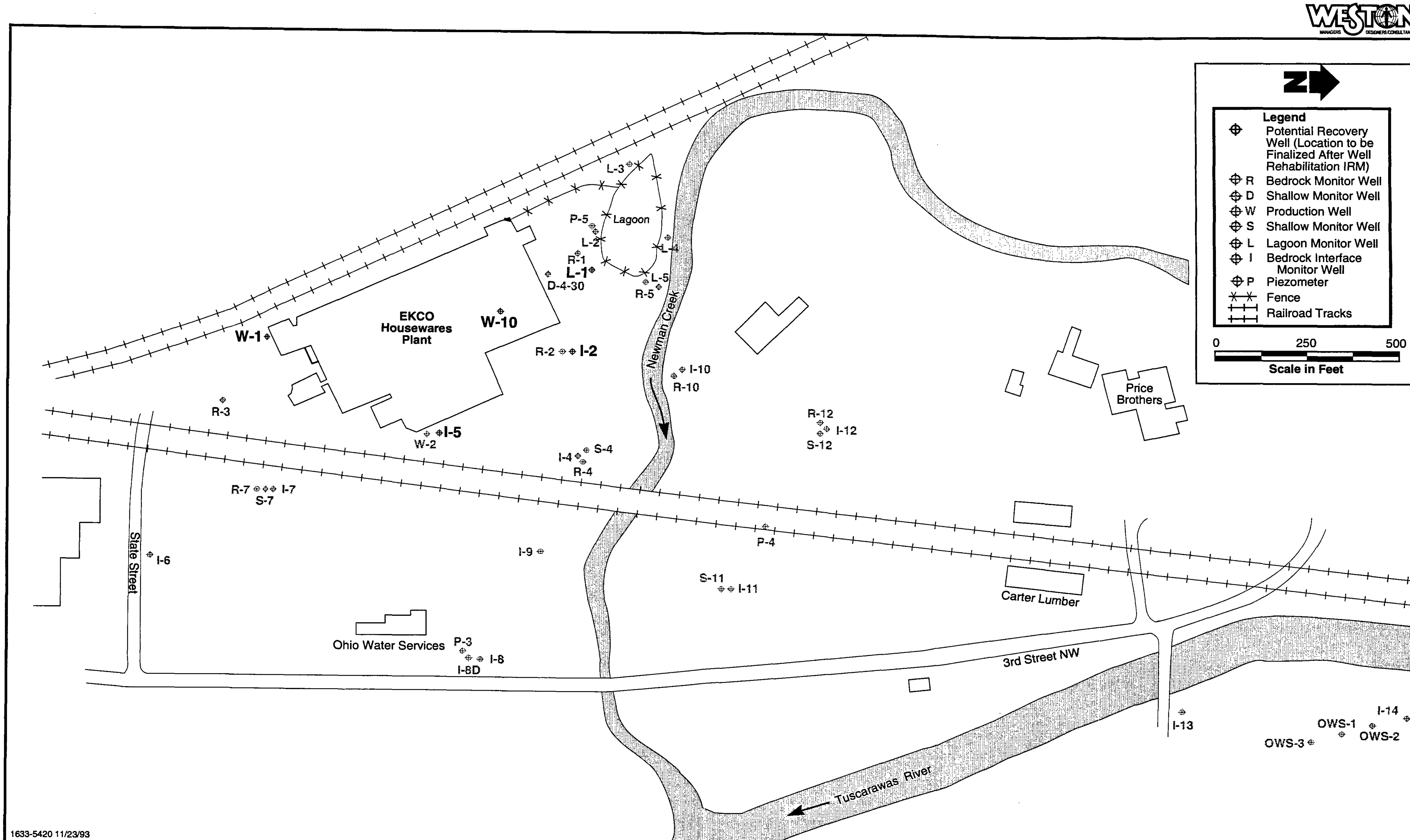

FIGURE 5-2 ALTERNATIVE GROUNDWATER - 3
RECOVERY WELL LOCATION MAP

on currently available operating data). The recovery wells may need to be rehabilitated every 10 years. The existing groundwater recovery and treatment system has operated reliably since 1986. The modifications proposed in this alternative should not effect the level of reliability of the current system.

This alternative calls for the conversion of three existing monitoring wells to recovery wells and subsequent connection to the existing treatment system. The necessary pumps and piping are items that are readily available. Implementation of these changes would require some trenching for the pipe installation. These changes could be readily implemented within a short period of time. Minor permit modifications may be necessary.

Workers installing the pumps and the piping would have to wear proper protective clothing to avoid direct contact with VOC-contaminated groundwater and soils. These activities would have no effect on the community.

5.3.3.2 Environmental Evaluation

This alternative will prevent the off-site migration of contaminated groundwater. VOCs in the recovered groundwater will be treated using the existing permitted air stripper. The treated groundwater will be discharged through Outfall No. 001 in accordance with the facility's NPDES permit. No adverse effect to the air or the surface water is expected. The recovery groundwater system will be operated until target levels are reached. At this time it is not possible to accurately predict the duration that groundwater recovery may be needed.

5.3.3.3 Human Health Evaluation

The deep water-bearing zone is currently being used as a source for public drinking water by OWS. OWS currently operates three wells that are located 2,000 ft northeast of the EKCO facility. This alternative will prevent the migration of contamination from the EKCO facility to these wells. The well restriction program will prevent the unauthorized use of groundwater that could draw contamination off-site.

5.3.3.4 Institutional Evaluation

Implementation of the well restriction program to prevent potential off-site migration of VOC-contaminated groundwater will require the cooperation of local property owners, the City of Massillon, and OEPA. The owners of the affected properties may not wish to cooperate.

5.3.3.5 Cost Evaluation

Capital costs for this alternative include pumps for the additional recovery wells, piping from the wells to the air stripper, and the implementation of a well restrictions program. Table 5-3 presents estimated order-of-magnitude capital costs for this option. The estimated total capital cost for this option is $173,000. Operating and maintenance costs include labor, utilities, and monitoring of the system performance and the groundwater. Table 5-4 presents the estimated order-of-magnitude operating and maintenance costs for this alternative. The estimated total yearly operating and maintenance costs are $154,000.

5.4 DETAILED ANALYSIS OF SOURCE-CORRECTIVE ALTERNATIVES

This section addresses the source-corrective alternatives for the EKCO facility. Based on the volume estimates described in Subsection 2.4.1, it is projected that 3,500 yd^3 of VOC-contaminated soil underneath the building and 4,900 yd^3 of VOC-contaminated soil outside the building will require remediation. The areas of soil contamination are presented in Figure 5-3. Alternatives are detailed separately for sources beneath the building and outside the building in subsections 5.4.1 and 5.4.2, respectively.

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Table 5-3

Estimated Order-of-Magnitude Capital Costs for Alternative GW-3 (Use of Additional Overburden Recovery Well and Pulse-Pumping of Wells W-1 and W-10)

Item	Description	Quantity	Unit Cost ($)	Total Cost ($)
1	Groundwater Model Development	Lump Sum	35,000	35,000
2	Well Pumps and Controls	3	3,000	9,000
3	Pulse Pumping Test	Lump Sum	20,000	20,000
4	New Recovery Well Pumping Tests	Lump Sum	20,000	20,000
5	Installation of Piping and Conduit	800 ft	20/ft	16,000
6	Tie into Existing System	3	500	1,500
7	Pulse Pumping Controls	1	1,000	1,000
	Subtotal			117,500
8	Administrative (22%)			25,900
9	Contingency (25%)			29,400
	Total			173,000

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Table 5-4

Estimated Order-of-Magnitude Operating and Maintenance Costs for Alternative GW-3 (Use of Additional Overburden Recovery Well and Pulse-Pumping of Wells W-1 and W-10)

Item	Description	Quantity	Unit Cost ($)	Total Cost/ Year ($)*
1	Labor	Lump Sum	26,000	26,000
2	Analytical	Lump Sum	38,000	38,000
3	Maintenance	Lump Sum	4,400	4,400
4	Utilities	Lump Sum	36,500	36,500
	Subtotal			104,900
5	Administrative (22%)			23,100
6	Contingency (25%)			26,200
	Total			154,000

*Years 1 through 30.

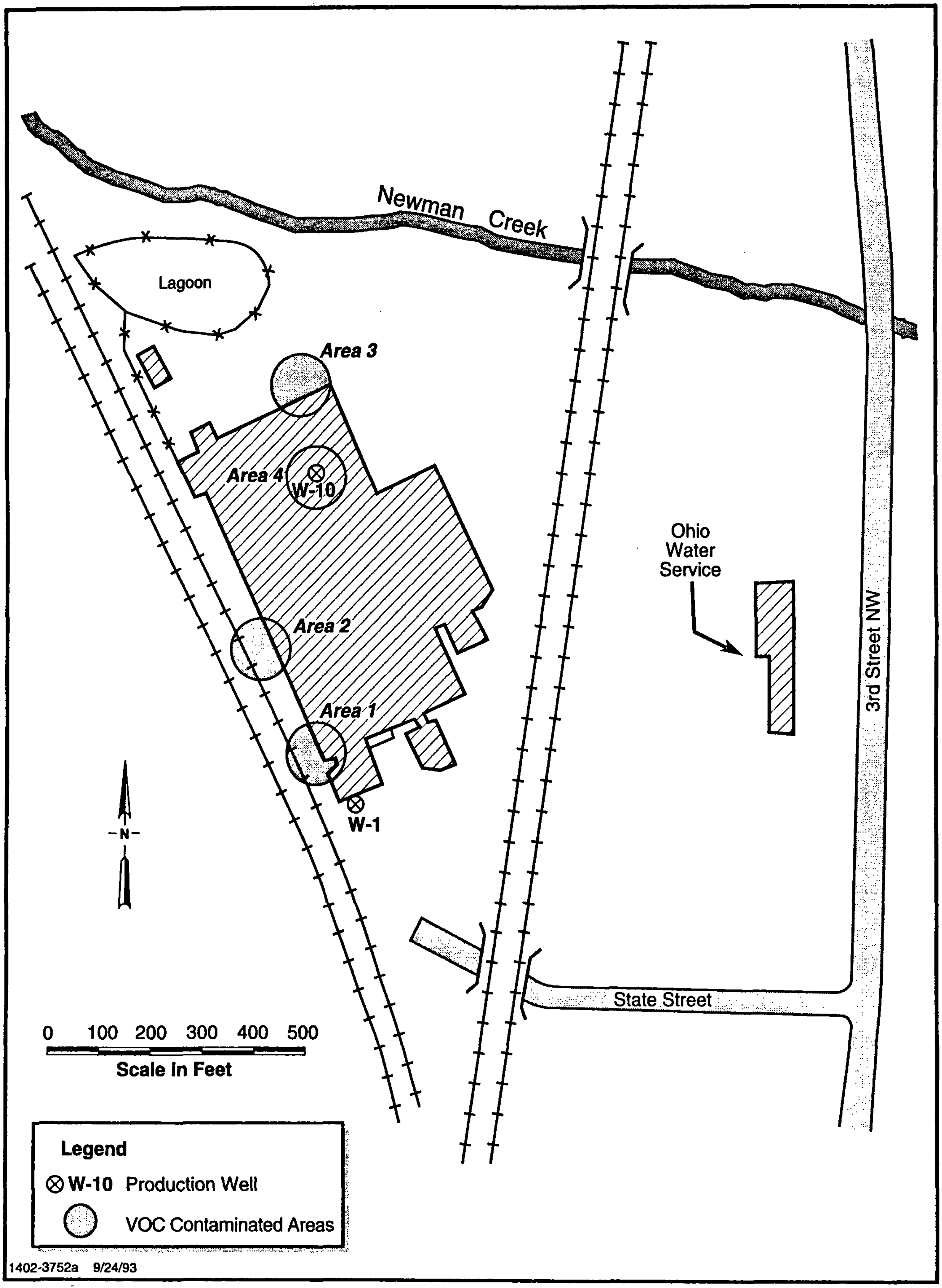


FIGURE 5-3 VOC-CONTAMINATED AREAS EXCEEDING SOIL CLEANUP GOALS

5.4.1 Source-Corrective Alternatives for Soils Beneath the Building

This section addresses the source-corrective alternatives below the building at the EKCO facility. As part of the RFI, three soil borings were advanced into the soils underneath the building. 1,2-DCE was detected in one sample at a level (34 mg/kg) exceeding the cleanup levels proposed in Subsection 2.4.2.2. This area of contamination was detected in a sample collected from a 10 to 12-ft depth interval. Three alternatives are compared in the following subsections:

- No action
- Vertical SVE
- Horizontal SVE

5.4.1.1 Alternative IS-1: No Action

The no-action alternative for soils beneath the building at EKCO provides a basis for comparing existing site conditions with those resulting from implementation of the other proposed alternatives. Under the no-action alternative, no additional measures will be used to remediate the contaminant source or any potential migration pathways. VOC contamination would not be reduced in this no-action scenario, except through natural degradation processes; however, the potential for exposure to contaminated soil under the building is low given the current land use. Furthermore, it is unlikely that this VOC contamination would dramatically affect groundwater. Much of the shallow water-bearing zone underneath the building is currently dewatered, and infiltration as a mechanism for transporting contamination is greatly reduced because of the building.

Technical Evaluation

Because no actions are implemented under this alternative, there is no technical evaluation of performance or reliability. The ability to meet soils objectives under this alternative would take decades at best through natural degradation. This alternative is readily implemented because it is currently the present condition and requires no operational and maintenance controls. Because no actions are taking place, this alternative can be safely implemented.

Environmental Assessment

Implementation of the no-action alternative may a negative effect on the environment. Contaminant reduction over time would be slow; however, given the reduced infiltration and the depth to groundwater in the area, the impact to groundwater is considered very small.

Human Health

Implementation of the no-action alternative may have a negative effect on human health. Contaminant reduction over time would be slow. While the potential exists for contamination to leach from the contaminated vadose soils into the shallow or the bedrock water-bearing zones, the current pump and treat system would capture this contamination. If this system were turned off, minimal migration of VOCs in the soils may occur through infiltration. Therefore, this alternative would ultimately not be protective of groundwater. Implementation would not have any additional adverse effects.

Institutional

The no-action alternative should theoretically be easily implemented because there are not currently any laws requiring action for particular contaminants at various concentrations in soils.

Cost Estimate

No costs would be incurred under the no-action alternative.

5.4.1.2 Alternative IS-2: Vertical SVE

This alternative is designed to remediate the 1,2-DCE source area underneath the northeastern corner of the plant near extraction well W-10. SVE is an active remediation technology that can have several advantages over passive recovery systems. SVE has been demonstrated effective at several sites with the soil types found at the EKCO site (EPA/540/A5-89/003, July 1989).

SVE removes VOCs from the soil vadose zone by mechanically drawing air through the soil pore space. This is accomplished by installing several vents in the vadose zone and applying a vacuum using a blower. VOCs volatilize into the air as the air moves through the soil. The VOC-laden air stream is then collected and either discharged or treated, depending on the amount and type of organic compounds present. The major considerations in applying the technology are the contaminant volatility, site soil porosity, and the desired soil cleanup level. These considerations affect the time of cleanup and number of vents per unit area.

A pilot system would be operated for 2 weeks. The purpose of this phase would be to determine the final design of the full scale system, including vent placement, and to confirm whether air injection is necessary.

A typical SVE design would contain the following components:

- Soil vents.
- Positive displacement blower.
- Laterals and headers (manifold).
- Knockdown drum (liquid/vapor separator).
- In-line air filter.
- Vapor treatment (e.g., granular activated carbon).
- Pressure monitoring probes.

Soil vents are connected by laterals and headers to the knockdown drum and then to a particulate filter before entering the inlet to the blower. The knockdown drum removes entrained water from the extracted vapor, while the filter removes particulates that may damage the blower or clog the vapor treatment system. Upon exit from the blower, the extracted vapor passes through a heat exchanger to reduce the temperature prior to the subsequent carbon treatment. Pressure probes are used to determine the inlet and discharge static pressures on the blower as well as the flow from each vent. This is done so that the flow rates may be optimized for specific equipment and site conditions. A typical SVE blower unit component system is shown in Figure 5-4. A typical vent construction is shown is Figure 5-5, while a typical lateral and header connection manifold system is shown in Figure 5-6. A typical pressure monitoring probe is shown in Figure 5-7.

The relative permeability of the soil determines the radius of influence of each vent, a design parameter that determines the number and location of the extraction vents in an SVE system. The radius of influence is defined as the maximum distance from the extraction vent at which subsurface air flow (as measured by the pressure gradient toward the vent) is observed. This implies that all soils within this radius are subject to treatment. For the low permeability soils encountered at the EKCO facility, a radius of influence of 10 ft should be realistic.

Air injection is a technique that is frequently used to improve SVE performance in low permeability soils. Air injection can improve SVE performance through several mechanisms. By injecting air, the soils can be pneumatically fractured, thereby creating additional flow pathways. Air injection can also serve to dry out a soil and reduce the resistance to air flow.

Based on the current site information, it is projected that 25 vents would be required to treat the soil underneath the building. It is uncertain whether air injection would be necessary. Implementation of this alternative would begin with the installation of a pilot system. This system would consist of three vents, five pressure-monitoring locations, and two air injection points. The vents would be installed through the building floor using a hollow stem auger, which would be advanced to a depth of 16 ft. Soil samples would be collected every 4 ft and analyzed for VOCs. These samples would be used to establish baseline conditions. The vents would be screened from 8 to 16 ft. The piping would be manifolded

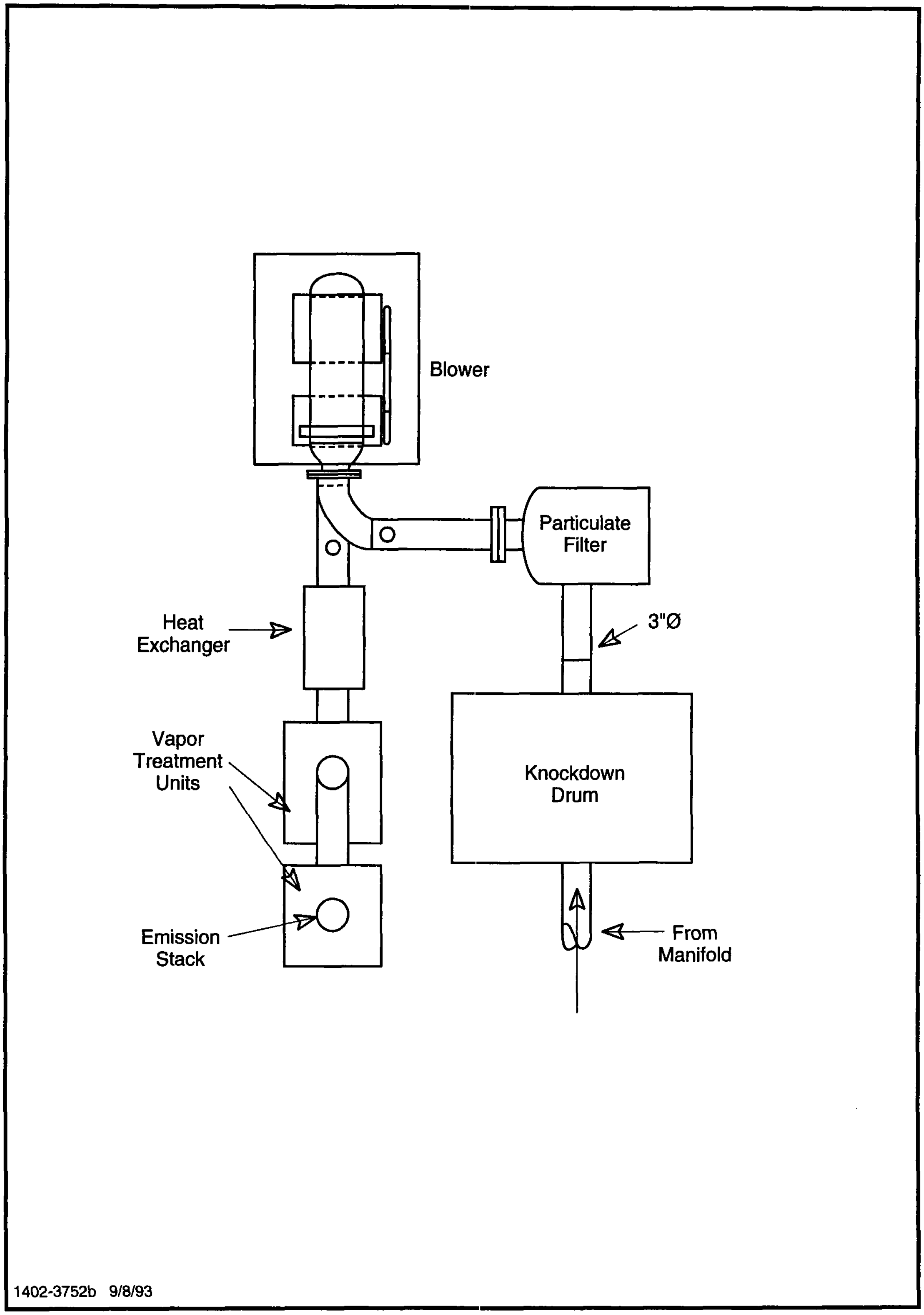


FIGURE 5-4 SVE BLOWER UNIT COMPONENT/CONNECTIONS

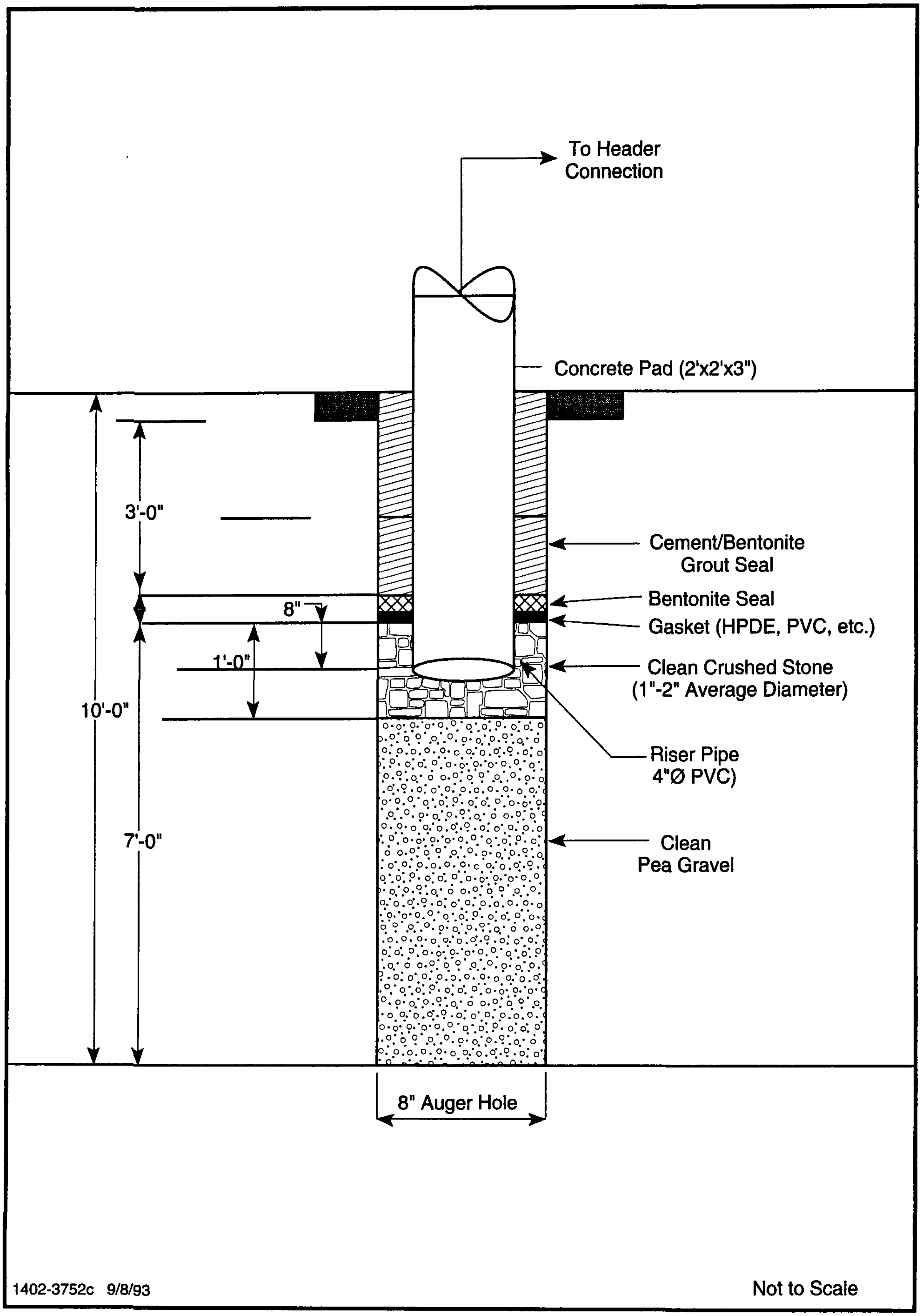


FIGURE 5-5 TYPICAL SVE VENT CONSTRUCTION

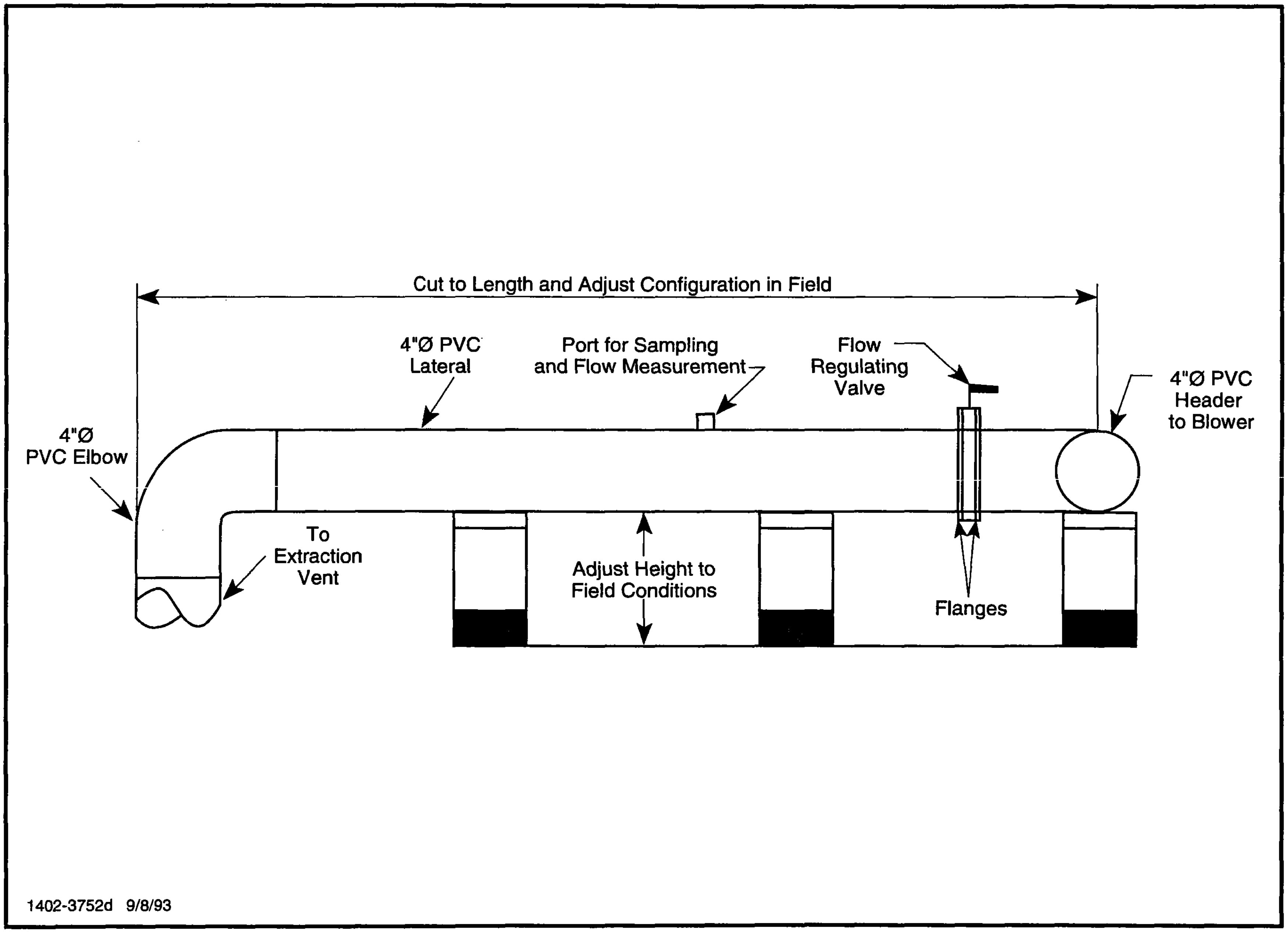
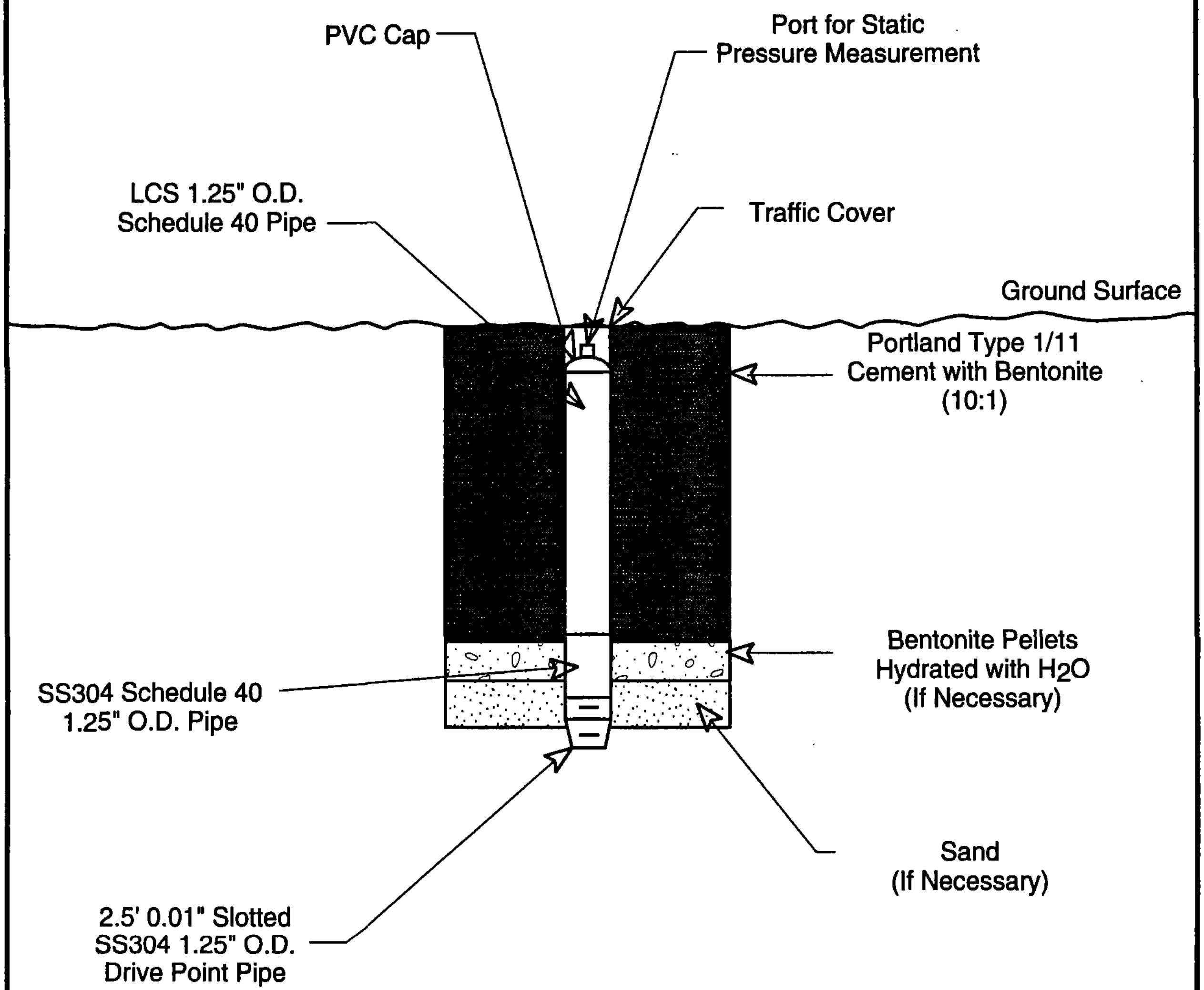


FIGURE 5-6 TYPICAL SVE LATERAL AND HEADER CONNECTIONS



Notes:

1. Location of Probes will be Field Adjusted to be out of Traffic Areas
2. LCS - Low Carbon Steel
3. SS - Stainless Steel

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FIGURE 5-7 TYPICAL SVE PRESSURE MONITORING PROBE

and piped outside to a high vacuum unit. The vacuum discharge would be connected to two granular-activated carbon units in series.

Technical Evaluation

VOC levels and air flow rate will be monitored at each vent and for the entire system to monitor VOC removal rates. During long term SVE operation, VOC levels tend to approach a steady state value. When this occurs, approximately five borings would be installed through the floor. Three samples will be collected from each boring for VOC analysis. These results will be used to determine whether the soil objectives have been met. Similar SVE systems have operated reliably after the initial startup. Siltation of the vents may occur during the extraction. When this occurs, it is usually necessary to drill a new boring. After the initial startup, SVE systems may be left unattended for long periods of time, except when replacement or regeneration of the carbon units becomes necessary. It is expected that the full scale system would be operated for 1 year. Given this time frame, only minor vacuum pump maintenance would be expected. Vacuum pumps and air compressors are readily available equipment. An air permit would be required prior to construction of the SVE system. It is expected that the pilot system could begin operation within 120 days of receipt of the permit to construct.

Safety concerns during startup of the SVE system will be minimal because the carbon vapor treatment system is sized to accommodate initial concentrations, and the concentrations tend to drop after operation begins. Workers will have to wear proper protective clothing to avoid direct contact with VOC-contaminated soil.

During operation of the SVE, the removal rate of the contaminants is expected to continually decrease, approaching an asymptotic level. At that time, the system would be shut down and confirmation sampling performed to determine whether the cleanup standard has been achieved. This confirmation sampling would consist of approximately 10 soil borings, with two samples from each boring collected for VOC analysis. These analytical results would be used to determine if the remediation had achieved its objective.

Environmental Assessment

Implementation of the SVE system would have little short-term adverse environmental effects. This alternative will prevent potential recontamination of groundwater by soils underneath the building. The recovered VOC-laden air will be treated using granular activated carbon; therefore, no adverse effect on air quality would be expected.

Human Health

Implementation of the SVE system will pose little risk to human health, except by possible exposure to the drilling and installation crews. TCE and TCA may volatilize from the boring areas. The work crews will use the appropriate OSHA/NIOSH permissible exposure limits to determine the level of protection needed to protect human health. There would be no exposure to plant workers following initiation of system operations.

Institutional

Discharges from the SVE system to the ambient air will require a discharge permit from OEPA. No institutional concerns would be expected with the implementation of this alternative.

Cost Estimate

Capital costs for this alternative include installation and startup of the pilot and full-scale systems. Table 5-5 presents the estimated order-of-magnitude capital costs for this option. The total estimated capital costs are $524,000. Operating and maintenance costs include labor, utilities, and monitoring of the system performance. Table 5-6 presents the estimated order-of-magnitude operating and maintenance costs for this alternative. The monthly operating and maintenance cost is estimated at $19,000. At the end of the operation, confirmation samples will be collected at a cost of $19,000.

Table 5-5

Estimated Order-of-Magnitude Capital Costs for Alternative IS-2 (Vertical SVE)

Item	Description	Quantity	Unit Cost ($)	Total Cost ($)
1	Design of Pilot SVE	1	Lump Sum	6,000
2	Permitting	1	Lump Sum	8,600
3	Installation of Pilot SVE	1	Lump Sum	45,000
4	Testing of Pilot SVE	1	Lump Sum	25,000
5	Design of Full-Scale SVE	1	Lump Sum	15,000
6	Permit Modifications	1	Lump Sum	2,100
7	Installation of Full-Scale SVE	1	Lump Sum	210,000
8	Startup of Full-Scale SVE	1	Lump Sum	45,000
	Subtotal			356,700
9	Administrative (22%)			78,500
10	Contingency (25%)			89,200
	Total			524,000

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Table 5-6

Estimated Order-of-Magnitude Operating and Maintenance Costs for Alternative IS-2 (Vertical SVE)

Item	Description	Monthly Quantity	Unit Cost ($)	Total Cost/ Month ($)
1	Labor	Lump Sum		3,600
2	Maintenance	Lump Sum		700
3	Utilities	Lump Sum		800
4	Vacuum Unit Rental	1	3,000	3,000
5	Carbon Vessel Rental	2	500/unit	1,000
6	Carbon Replacement	120 lbs	3.60/lb	400
7	Analysis - Emissions	30/month	120/sample	3,600
	Subtotal			13,100
8	Administrative (22%)			2,900
9	Contingency (25%)			3,300
	Total			19,000

Note: At the end of the remediation, a one-time confirmation sampling cost of $19,000 will be incurred.

5.4.1.3 Alternative IS-3: Horizontal SVE

This alternative is designed to remediate the 1,2-DCE source area underneath the northeastern corner of the plant near extraction well W-10. Functionally, horizontal SVE operates in the same manner as vertical SVE in removing VOCs (see the previous discussion of SVE in Subsection 5.3.1.2) It is expected that for the low permeability soils encountered at the EKCO facility, a radius of influence of 5 ft for horizontal SVE should be realistic.

Based on the current site information, it is projected that 10 horizontal vents would be required to treat the soil underneath the building. It is uncertain whether air injection would be necessary. Implementation of this alternative would begin with the installation of a pilot system. This system would consist of three vents, five pressure-monitoring locations, and two air injection points. The vents would be installed from the outside of the building, on either the northern or eastern side, using a horizontal drilling device. The auger would be advanced to the depth between 8 and 16 ft, depending on the location of the particular vent (see Figure 5-4 for a diagram) for a screened length of 100 ft. Soil samples would be collected every 10 ft along the horizontal borehole in the contaminated zone and analyzed for VOCs. These samples would be used to establish baseline conditions. The piping would be manifolded and piped outside to a high vacuum unit. The vacuum discharge would be connected to two granular activated carbon units in series.

The pilot system would be operated for 2 weeks. The purpose of this phase would be to determine the final design of the full-scale system, including vent placement and whether air injection is necessary.

<u>**Technical Evaluation**</u>

VOC levels and air flow rate will be monitored at each vent and for the entire system to monitor VOC removal rates. During long-term SVE operation, VOC levels tend to approach a steady-state value. At this time, approximately five borings would be installed through the floor. Three samples will be collected from each boring for VOC analysis. These results will be used to determine whether the soil objectives have been met.

Similar SVE systems have operated reliably after the initial startup. Siltation of the vents may occur during the extraction. When this occurs, it is usually necessary to drill a new well. After the initial startup, SVE systems may be left unattended for long periods of time except when replacement or regeneration of the carbon units becomes necessary. It is expected that the full scale system would be operated for 1 year. Given this time frame, only minor vacuum pump maintenance would be expected. Vacuum pumps and air compressors are readily available equipment. An air permit would be required prior to construction of the SVE system. It is expected that the pilot system could begin operation within 120 days of receipt of the permit to construct.

Safety concerns during startup of the SVE system will be minimal because the carbon vapor treatment system is sized to accommodate initial concentrations. Workers will have to wear proper protective clothing to avoid direct contact with VOC-contaminated soils.

During operation of the SVE, the removal rate of the contaminants is expected to continually decrease, approaching an asymptotic level. At this time, the system would be shut down and confirmation sampling performed to determine whether the cleanup standard has been achieved. This confirmation sampling would consist of approximately 10 soil borings, with two samples from each boring collected for VOC analysis. These analytical results would be used to determine if the remediation had achieved its objective.

<u>**Environmental Assessment**</u>

Implementation of the horizontal SVE system would have few short-term adverse environmental effects. This alternative will prevent potential contamination of groundwater by soils underneath the building. Given the reduced infiltration and the depth to groundwater in the area, this migration pathway is considered minimal. The recovered

VOC-laden air will be treated using granular activated carbon; therefore, no adverse effect on air quality would be expected.

Human Health

Implementation of the SVE system will pose little risk to human health except to the drilling and installation crews. TCE and TCA may volatilize from the boring areas. The crews will use the appropriate OSHA/NIOSH permissible exposure limits to determine the level of protection needed to protect human health. Discharges from the SVE system to the ambient air will require a discharge permit from OEPA.

Institutional

No institutional concerns would be expected with the implementation of a horizontal SVE system to remediate soils underneath the building.

Cost Estimate

Capital costs for this alternative include installation and startup of the pilot and full-scale systems. Table 5-7 presents the estimated order-of-magnitude capital costs for this option. The total estimated capital cost is $937,000. Operating and maintenance costs include labor, utilities, and monitoring of the system performance. Table 5-8 presents the estimated order-of-magnitude operating and maintenance costs for this alternative. The total monthly operating and maintenance costs are estimated at $17,000. At the end of the remediation, confirmation samples will be collected at a cost of $19,000.

5.4.2 Source-Corrective Alternatives for Soils Outside the Building

This section addresses the source-corrective alternatives for addressing contaminated soils located outside the building at the EKCO facility. Six alternatives are compared in the following subsections:

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Table 5-7

Estimated Order-of-Magnitude Capital Costs for Alternative IS-3 (Horizontal SVE)

Item	Description	Quantity	Unit Cost ($)	Total Cost ($)
1	Design of Pilot SVE	1	Lump Sum	8,000
2	Permitting	1	Lump Sum	8,600
3	Installation of Pilot SVE	1	Lump Sum	170,000
4	Testing of Pilot SVE	1	Lump Sum	24,000
5	Design of Full-Scale SVE	1	Lump Sum	20,000
6	Permit Modifications	1	Lump Sum	2,100
7	Installation of Full-Scale SVE	1	Lump Sum	360,000
8	Startup of Full-Scale SVE	1	Lump Sum	45,000
	Subtotal			637,700
9	Administrative (22%)			140,300
10	Contingency (25%)			159,000
	Total			937,000

Table 5-8

Estimated Order-of-Magnitude Operating and Maintenance Costs for Alternative IS-3 (Horizontal SVE)

Item	Description	Annual Quantity	Unit Cost ($)	Total Cost/ Month ($)
1	Labor	Lump Sum		3,600
2	Maintenance	Lump Sum		700
3	Utilities	Lump Sum		800
4	Vacuum Unit Rental	1	3,000	3,000
5	Carbon Vessel Rental	2	500/Unit	1,000
6	Carbon Unit Replacement	120 lbs	3.60/lb	460
7	Analysis	15	120/sample	1,800
	Subtotal			11,300
8	Administrative (22%)			2,500
9	Contingency (25%)			2,900
	Total			17,000

Note: At the end of the remediation, a one-time confirmation sampling cost of $19,000 will be incurred.

- No action.
- Fence and post warning signs.
- Vertical SVE.
- Ex situ volatilization.
- Low temperature thermal treatment.
- Off-site disposal/incineration.

5.4.2.1 Alternative OS-1: No Action

The no-action alternative for soils outside the building at EKCO provides a basis for comparing existing site conditions with those resulting from implementation of the other proposed alternatives. Under the no-action alternative, no additional measures will be used to remediate the contaminant source or their potential migration pathways. VOC contamination would not be reduced in this no-action scenario, except through natural degradation processes. Based on the contaminant transport modeling results presented in Subsection 2.4.1, VOC contamination would affect groundwater. The shallow water-bearing zone is currently dewatered along the western side of the building, thereby reducing contaminant transport from two areas of VOC contamination in that area.

<u>**Technical Evaluation**</u>

Because no actions are implemented under this alternative, there is no technical evaluation of performance or reliability. The ability to meet soils objectives under this alternative would take decades at best through natural degradation. This alternative is readily implemented because it is currently the present condition and requires little or no operational and maintenance controls. Because no actions are taking place, this alternative can be safely implemented.

<u>**Environmental Assessment**</u>

Implementation of the no-action alternative will have a negative effect on the environment. Contaminant reduction over time would be slow while concentrations could continue to leach from the contaminated vadose soils into the shallow aquifer. It is projected that shallow groundwater recovery will be performed for more than 30 years. Under the no-action alternative, it is expected that the period of operation of the shallow groundwater recovery system would be extended because of continuing impacts to groundwater from VOC-contaminated soils.

Human Health

Implementation of the no-action alternative will have a negative effect on human health. The potential for direct exposure to contaminated soils would remain. Contaminant reduction over time would be slow while concentrations would continue to leach from the contaminated vadose soils into the shallow or the bedrock water-bearing zones; however, the current recovery system would capture this contamination. If the current pump-and-treat system were deactivated, VOCs in the soils might migrate off-site. This alternative would ultimately not be protective of groundwater. Implementation would not have any additional adverse affects.

Institutional

The no-action alternative should theoretically be easily implemented because there are not currently any laws requiring action for particular contaminants at various concentrations in soils. In practice, some remediation of source contamination is usually required by either the state or federal EPA based on the proposed RCRA regulations and contaminant transport modeling, as presented in Section 2. Based on the action levels developed in Section 2, remediation may be required for TCE contamination.

Cost Estimate

No costs would be incurred under the no-action alternative.

5.4.2.2 Alternative OS-2: Fence and Post Warning Signs

Under this alternative, areas outside the building that are contaminated over RCRA corrective action guidelines would be fenced and posted to prevent unauthorized contact. No additional measures would be used to remediate the contaminant sources or their potential migration pathways. VOC contamination would not be reduced in this scenario, except through natural degradation processes. The potential for exposure to contaminated soil outside the building would be further reduced because the fencing would restrict access to contaminated areas.

Technical Evaluation

Fencing and posting can reliably prevent unauthorized contact in an area closely supervised by nearby operations. The ability to meet soils objectives under this alternative would take decades at best through natural degradation. This alternative is readily implemented because the technology is readily available and requires little or no operational and maintenance controls. This alternative can be safely implemented because it uses conventional construction techniques.

Environmental Assessment

Implementation of this alternative would have a negative effect on the environment. Contaminant reduction over time would be slow while constituents could continue to leach from the contaminated vadose soils into the shallow aquifer.

Human Health

Implementation of the fence and post alternative will pose little risk to human health except to the fence installation crews. Installation of a fence would reduce the potential for direct contact with soil contamination. Contaminant reduction over time would be slow while concentrations would continue to leach from the contaminated vadose soils into the shallow or the bedrock water-bearing zones; however, the current recovery system would capture this contamination. If the current pump-and-treat system were turned off, VOCs in the soils might migrate off-site. This alternative would not be protective of groundwater. Implementation would not have any additional adverse effects.

Institutional

The fence and post alternative should theoretically be easily implemented because there are not currently any laws requiring action for particular contaminants at various concentrations in soils. In practice, some remediation of source contamination may be required by either the state or federal EPA based on the proposed RCRA regulations and contaminant transport modeling, as presented in Section 2. Based on the action levels developed in Section 2, remediation may be required for TCE contamination.

Cost Estimate

Costs are expected to be minimal. A one time outlay of approximately $10,000 would be needed to install fencing and signs. Maintenance of the areas would consist of periodic fence repairs and sign replacement, and would cost approximately $500 yearly.

5.4.2.3 Alternative OS-3: Vertical SVE

This alternative is designed to remediate the two TCE source areas to the west and the southwest of the main plant as well as the TCA source area to the northeast of the plant. Functionally, the use of SVE to remediate contaminated soils outside the building is the same as the approach for soils underneath the building (see the previous discussion of SVE in Subsection 5.3.1.2). It is expected that for the low permeability soils encountered at the EKCO facility, a radius of influence of 10 ft should be realistic.

Implementation of this alternative would begin with the installation of a pilot system. The purpose of this pilot system would be to determine the final design of the full scale systems, including vent placements and deciding whether air injection is necessary. This system would consist of three vents, five pressure monitoring locations, and two air injection points at Area 2. The vents would be installed using a hollow stem auger, which would be advanced to a depth of 12 ft. Soil samples would be collected every 4 ft and analyzed for VOCs. These samples would be used to establish baseline conditions in Area 2. The vents would be screened from 4 to 12 ft. The piping would be manifolded in each area to a vacuum unit. The vacuum discharge at each location would be connected to two granular activated carbon units in series. The pilot system would be operated for 2 weeks.

During operation of the pilot system, an additional five soil borings would be advanced in Areas 1 and 3. Three samples would be collected per boring for VOC analysis. These borings would be used to establish baseline conditions prior to operation of the full scale SVE.

Based on the current site information, it is projected that 13 vents per location with air injection would be required to treat the soils at each outside location. The contamination at Area 1 is shallow (2 to 4 ft). An impervious cover would be placed on the surface to prevent short-circuiting.

Technical Evaluation

VOC levels and air flow rate will be monitored at each vent and for each of the three systems to monitor VOC removal rates. During long term SVE operation, VOC levels tend to approach a steady state value. At this time, approximately five borings would be installed in each SVE area. Three samples will be collected from each boring for VOC analysis. These results will be used to determine whether the soil objectives in each area have been met.

Similar SVE systems have operated reliably after the initial startup. Siltation of the vents may occur during the operation. When this occurs, it is usually necessary to drill a new well. After the initial startup, SVE systems may be left unattended for long periods of time except when replacement or regeneration of the carbon units becomes necessary. It is expected that the full scale systems would be operated for 1 year. Given this time frame, only minor maintenance of the vacuum pumps would be expected. Vacuum pumps and air compressors are readily available equipment. An air permit for each SVE system would be required prior to construction. It is expected that the pilot systems could begin operation within 120 days of receipt of the permit.

Safety concerns during startup of the SVE systems will be minimal because the carbon vapor treatment systems are sized to accommodate initial concentrations. Workers must wear proper protective clothing to avoid direct contact with VOC-contaminated soils.

During operation of the SVE, the mass of the contaminants removed by the total system will reach an asymptotic level. At this time, the system would be shut down and confirmation sampling performed to determine whether the cleanup standard had been achieved. This confirmation sampling would consist of approximately 15 soil borings, with two samples collected for VOC analysis. These analytical results would be used to determine if the remediation had achieved its objective.

Environmental Assessment

Implementation of the SVE systems will pose little short-term adverse environmental effects. This alternative will prevent recontamination of groundwater by soils outside the building. The recovered VOC-laden air will be treated using granular activated carbon; therefore, no adverse effect on air quality would be expected.

Human Health

Implementation of the SVE systems will pose little risk to human health except to the drilling and installation crews. TCE and TCA may volatilize from the boring areas. They will use the appropriate OSHA/NIOSH permissible exposure limits to determine the level of protection needed to protect human health. Discharges from each of the SVE systems to the ambient air will require a permit from OEPA, who set discharge limits based on human health considerations.

Institutional

Construction and operation of an SVE will require an air permit from OEPA.

Cost Estimate

Capital costs for this alternative include installation and startup of the pilot and full-scale systems. Table 5-9 presents the estimated order-of-magnitude capital costs for this option. The total capital costs are $762,000. Operating and maintenance costs include labor, utilities, and monitoring of the system performance. Table 5-10 presents the estimated order-of-magnitude operating and maintenance costs for this alternative. The estimated monthly operating and maintenance costs are $46,000. At the end of the operation, confirmation samples would be collected at a cost of $26,000.

5.4.2.4 Alternative OS-4: Ex Situ Volatilization

Under this alternative, the three areas of soil contamination outside the building would be excavated. This soil would be placed on an impervious surface for treatment. The VOCs would be removed through a series of horizontal pipes installed in the soil and connected to a vacuum pump. The removed VOCs would be treated using granular activated carbon. Following successful treatment, the soil would be returned to the excavation.

Implementation of this alternative would begin with the installation of a pilot system. The purpose of this pilot system would be to determine the final design of the full scale systems. This system would consist of two vents and two pressure monitoring locations. Soil would be excavated and piled to a height of 8 ft on a 30 ft by 30 ft impermeable liner. The pilot system would be operated for 2 weeks.

Table 5-9

Estimated Order-of-Magnitude Capital Costs for Alternative OS-3 (Vertical SVE)

Item	Description	Quantity	Unit Cost ($)	Total Cost ($)
1	Design of Pilot SVE	1	Lump Sum	5,000
2	Permitting	1	Lump Sum	13,000
3	Installation of Pilot SVE	1	Lump Sum	20,000
4	Testing of Pilot SVE	1	Lump Sum	24,000
5	Design of Full-Scale SVE	1	Lump Sum	25,000
6	Permit Modifications	1	Lump Sum	5,000
7	Installation of Full-Scale SVE	3	120,000	360,000
8	Startup of Full-Scale SVE	3	22,000	66,000
	Subtotal			518,000
9	Administrative (22%)			114,000
10	Contingency (25%)			130,000
	Total			762,000

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Table 5-10

Estimated Order-of-Magnitude Operating and Maintenance Costs for Alternative OS-3 (Vertical SVE)

Item	Description	Monthly Quantity	Unit Cost ($)	Total Cost/ Month ($)
1	Labor	Lump Sum		7,200
2	Maintenance	Lump Sum		1,400
3	Utilities	Lump Sum		1,500
4	Vacuum Unit Rental	3	3,000	9,000
5	Carbon Vessel Rental	6	500/unit	3,000
6	Carbon Replacement	800 lbs	3.60/lb	2,900
7	Analysis	50	120/sample	6,000
	Subtotal			31,000
8	Administrative (22%)			6,800
9	Contingency (25%)			7,800
	Total			46,000

Note: At the end of the remediation, a one-time confirmation sampling cost of $26,000 will be incurred.

Implementation of this approach and the pilot study will require the designation of a corrective action management unit (CAMU) at the facility. This approach is discussed in further detail in the following subsections. The site of the treatment would be cleared and graded to provide a relatively flat surface. An impermeable liner (100 ft by 100 ft) would be placed on the graded soil and bermed to prevent run-on. It is expected that a pad this size would only be sufficient to treat one-half the total volume of soil at a given time.

Prior to excavation, additional soil samples would be collected to determine the excavation volume. Six test pits would be excavated in Areas 1, 2, and 3 with three samples collected from each test pit for VOC analysis.

Based on the currently available data, excavation would proceed according to the volume estimates presented in Subsection 2.4.1. In Area 1, excavation would proceed to a depth of 8 ft for an approximate volume of 1,200 yd^3; in Area 2 to a depth of 10 ft for an approximate volume of 1,500 yd^3; and in Area 3 to a depth of 16 ft for an approximate volume of 2,300 yd^3. Each of these areas is located adjacent to the main building. Shoring would be installed to prevent undermining the structure during excavation and would continue until the remediated soils were returned to the excavation.

Two front-end loaders would be used for the excavation and placement on the pad. One would be used for the actual excavation, while the other would be used on the pad. The front-end loader on the pad would only have to be decontaminated once, after all soil placement was completed. Following placement of the first 5 ft of soil, 10 vent pipes would be installed, and then the final layer of soil. The placed soil would be covered with a UV-resistant membrane material over the entire beamed area. The vent pipes would be connected to a vacuum pump through a manifold. The vacuum pump would discharge the VOC-laden air to granular activated carbon units, arranged in series.

During operation of the extraction system, the mass of the contaminants removed by the total system will reach an asymptotic level. At this time, the system would be shut down and confirmation sampling performed to determine whether the cleanup standard had been achieved. This confirmation sampling would consist of approximately 10 soil samples collected for VOC analysis. These analytical results would be used to determine if the remediation had achieved its objective. Following confirmation of successful treatment, the soils would be returned to the excavations. These soils would be placed in 1-ft lifts and compacted.

Technical Evaluation

Ten samples will be collected from each area from the excavation sidewalls and bottom to confirm that all soils that exceed cleanup goals have been removed. The areas of excavation may be expanded based on these sample results. Confirmatory sampling may indicate that VOC contamination extends underneath the building. Excavation and treatment of any contamination that does extend underneath the building is not feasible.

VOC levels and air flow rate will be monitored at each vent and for the entire system to monitor VOC removal rates. During long-term operation, it is expected that VOC levels would tend to approach a steady state value. At this time, approximately 20 samples would be collected throughout the waste pile for VOC analysis. These results will be used to determine whether the soil objectives have been met.

The required time frame for this remediation is approximately 1 to 2 years. There is, however, little data regarding the operation of this technology.

Workers must wear proper protective clothing to prevent direct contact with VOC-contaminated soils and exposure to volatilization during excavation. Safety concerns during startup of the volatilization system will be minimal because the carbon vapor treatment system is sized to accommodate initial concentrations.

Environmental Assessment

This alternative will prevent contamination of groundwater by soils outside the building. The recovered VOC-laden air will be treated using granular activated carbon; therefore, no adverse effect on air quality would be expected from the operation of the treatment system. However, a substantial amount of the VOCs may volatilize into the air once excavation activities begin.

Human Health

Implementation of the operation will pose little risk to human health, except to personnel involved in the excavation. TCE and TCA may volatilize during excavation and fugitive dusts may require dust controls. The treatment unit will be covered to prevent fugitive dust. On-site air monitoring would be conducted during excavation of VOC-contaminated soil to determine the level of respiratory and dermal protection required by workers. OSHA/NIOSH-permissible exposure limits would be used to determine the level of protection needed to protect human health. Discharges from the SVE system to the ambient air will require a discharge permit from OEPA.

Institutional

To facilitate implementation of the on-site treatment system and to place the soil back into the excavation, a CAMU would need to be designated. The CAMU would cover the excavation areas and the treatment area. This process has only been recently developed, and it is uncertain what requirements might be made for the design of the containment pad and for the treated soils to be returned to the excavations.

Cost Estimate

Capital costs for this alternative include installation and startup of the system. Table 5-11 presents the estimated order-of-magnitude capital costs for this option. The total estimated

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Table 5-11

Estimated Order-of-Magnitude Capital Costs for Alternative OS-4 (Ex Situ Volatization)

Item	Description	Quantity	Unit Cost ($)	Total Cost ($)
1	Design of Pilot System	1	Lump Sum	8,000
2	Permitting	1	Lump Sum	20,000
3	Installation of Pilot System	1	Lump Sum	20,000
4	Testing of Pilot System	1	Lump Sum	32,000
5	Design of Full-Scale System	1	Lump Sum	20,000
6	Permit Modifications	1	Lump Sum	5,000
7	Installation of Treatment System	1	Lump Sum	150,000
8	Excavation and Placement of Soil	4,900 yd^3	25/yd^3	122,500
9	Installation of Shoring	9,255 ft^2	7.50/ft^2	70,000
10	Startup of Treatment System	1	Lump Sum	32,000
11	Backfilling of Treated Soils	4,900 yd^3	15/yd^3	73,500
	Subtotal			553,000
12	Administrative (22%)			122,000
13	Contingency (25%)			138,000
	Total			813,000

capital costs are $813,000. Operating and maintenance costs include labor, utilities, and monitoring of the system performance. Table 5-12 presents the estimated order-of-magnitude operating and maintenance costs for this alternative. The monthly operating and maintenance costs are estimated at $32,000. At the end of both batches, confirmation samples would be collected at a cost of $12,000 each.

5.4.2.5 Alternative OS-5: Low Temperature Thermal Treatment (LT^3)

Under this alternative, the three areas of soil contamination outside the building would be excavated. This soil would be pretreated to remove any large debris. The soil would then be conveyed into the treatment unit. The thermal desorption process removes volatile chemicals from soil by heating (100 to 200 °F) in an enclosed vessel. Contaminants released from the soil are carried by an induced airstream through a heat exchange to a carbon adsorption unit. Following successful treatment, the soil would be returned to the excavation. Implementation of this approach will require the designation of a CAMU at the facility. A general process diagram is presented in Figure 5-8.

Prior to excavation, additional soil samples would be collected to determine the excavation volume. Six test pits would be excavated in Areas 1, 2, and 3 with three samples collected from each test pit for VOC analysis. Excavation of the soils would proceed in the same manner as described in Alternative OS-4.

The site of the treatment unit would be cleared and graded to provide a relatively flat surface.

An on-site demonstration of the thermal desorption system would be required prior to full-scale operation to ensure compliance with federal and state air quality standards. This demonstration would require approximately 3 to 7 days. Pending successful completion of the demonstration, full-scale soil treatment could commence. Excavation, sampling and analysis, thermal desorption, and backfilling of the excavation with treated soil would

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Table 5-12

Estimated Order-of-Magnitude Operating and Maintenance Alternative Costs for OS-4 (Ex Situ Volatization)

Item	Description	Quantity	Unit Cost ($)	Total Cost Month ($)
1	Labor	Lump Sum	6,000	8,000
2	Maintenance	Lump Sum	1,200	1,500
3	Utilities	Lump Sum	1,300	1,300
4	Vacuum Unit Rental	2	3,000	6,000
5	Carbon Vessel Rental	2	500	1,000
6	Carbon Replacement	500 lb	3.60/lb	1,800
7	Analysis	15	120/sample	1,800
	Subtotal			21,400
8	Administrative (22%)			4,700
9	Contingency (25%)			5,400
	Total			32,000

Note: At the end of both batches, a confirmation sample cost of $12,000 would be incurred.

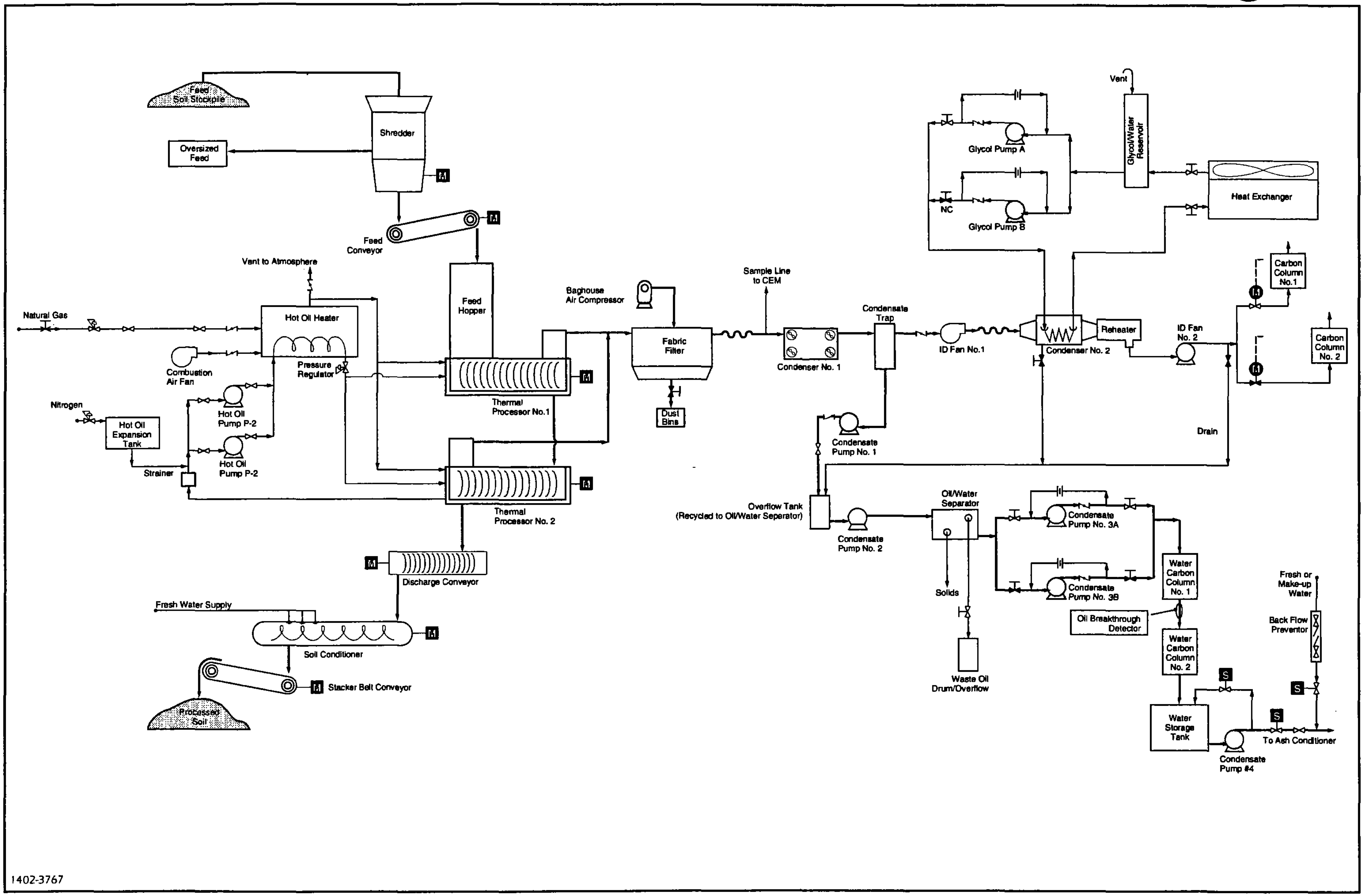

FIGURE 5-8 LT3 PROCESS DIAGRAM

proceed at an overall pace determined by the amount of waste requiring thermal treatment, but would be limited by the allowable process throughput rate. A typical mobile unit [7 to 10 tons per hour (tph)] with 70% availability (i.e., percentage of time in operation after subtracting downtime and startup/shutdown time) would process approximately 50 yd^3 per day (tpd). Approximately 3 to 4 months would therefore be required to treat the expected volume of soil requiring thermal treatment (4,900 yd^3). The feed rate to the thermal desorption unit would depend in part on soil characteristics. Thermal processes are generally less efficient in cohesive soils and soils with high moisture content. The thermal treatment process uses 2-inch-wide screens to minimize jamming of the thermal treatment system soil conveyance equipment. This process would generate untreatable debris and rocks that will not pass through the screens. Debris generated during soil screening would be backfilled in the excavation.

Thermal treatment processes generate additional residuals from the treatment of off-gases. For example, the treatment process produces baghouse dust and spent carbon. All residuals would be tested for hazardous waste characteristics and then disposed of off-site as appropriate. Spent carbon would be regenerated off-site.

Following thermal treatment, every 500 yd^3 of soil would be subjected to TCLP testing for metals to ensure that treatment had not concentrated or altered the leachability of metals in site soils, such that they exceed TCLP criteria. Total analysis would be conducted for VOCs to confirm expected contaminant destruction percentages. The treated soils would then be backfilled and compacted in the area of excavation to restore the site to its original grade.

Ambient air monitoring would be conducted during soil excavation, stockpiling, and treatment to determine the level of worker protection warranted and to evaluate potential air emissions that could affect the community. Continuous emissions monitoring for total hydrocarbons, carbon monoxide, carbon dioxide, and oxygen would be performed during soil treatment.

Technical Evaluation

Ten samples will be collected from the excavation sidewalls and bottom of each excavation area to confirm that all soils that exceed cleanup goals have been removed. The areas of excavation may be expanded based on these sample results. Confirmatory sampling may indicate that VOC contamination extends underneath the building. Excavation and treatment of any contamination that does extend underneath the building are not feasible.

The time required for installation of the thermal treatment system, groundwater treatment system, and associated activities is estimated at 3 to 4 months. The treatment of VOC-contaminated soil is expected to require 3 to 4 months.

No long-term management, monitoring, maintenance, or operation activities would be required under this alternative because no active operations or permanent structures would remain at the site on completion of the remedial actions.

An estimated 4,900 yd^3 of VOC-contaminated soil would be treated on-site by thermal treatment. Thermal treatment is a very effective technology for VOC removal from contaminated soil.

The residuals from treatment processes include treated soil unsuitable for backfilling. These residuals would be transported off-site for treatment and/or disposal.

There are several material handling difficulties that are expected in implementing thermal treatment:

- Gravel and rocks in the soil may adversely affect screw and belt conveyors because of their abrasive, sharp edges. Screens may be plugged or damaged by the combination of gravel, rocks, and debris.
- In most thermal systems, soil screening would be required to remove objects that could jam the screw conveyors.

- Moist or sticky soils affect the waste handling system. Wet soils clog or jam numerous types of conveying, screening, and feeding systems. Additionally, high-moisture content soils would result in the generation (after condensation) of higher volumes of wastewater. It is estimated that high-moisture content soils could reduce the processing rate substantially, thereby increasing the treatment cost accordingly.

The activities associated with excavation activities may be implemented with available engineering knowledge and equipment. Specialized construction equipment may be required for the construction of engineering controls to prevent undermining at the excavation limits. During the remediation period, treated soil would be sampled and analyzed in compliance with the regulatory requirements to confirm cleanup levels. Air emissions from the thermal treatment process would be monitored in accordance with regulatory requirements.

Operation and maintenance activities during the remedial actions could be implemented. This type of treatment unit is generally maintenance-intensive.

Environmental Assessment

This alternative will prevent recontamination of groundwater by soils outside the building. The recovered VOC-laden air will be treated using granular activated carbon; therefore, no adverse effect on air quality would be expected from the operation of the treatment system. However, a substantial amount of the VOCs may volatilize into the air once excavation activities begin and during excavation.

Human Health

On-site air monitoring would be conducted during excavation of VOC-contaminated soil to determine the level of respiratory and dermal protection required by workers. Excavated material would be covered with an impermeable layer in case of a temporary shutdown of the thermal treatment system, maintenance shutdown, or any other event that may result in excavated soil being exposed for an extended time period. No short-term risks from air emissions are expected to result from thermal treatment of soil because the operation would be conducted in accordance with stringent air emissions requirements. Continuous emissions monitoring would be performed for emissions from the thermal treatment system for carbon monoxide, carbon dioxide, oxygen, and total hydrocarbons. Air quality would also be measured near the site boundary to monitor potential emissions to the surrounding community.

The potential risk resulting from contaminants leaching from soil to groundwater would be reduced significantly. Groundwater use restrictions may be required until the zonewide management of migration objectives are met. Groundwater quality would improve over current levels significantly because the major source of contamination would be removed.

Institutional

To facilitate implementation of the on-site treatment system and to place the soil back into the excavation, a CAMU would need to be designated. This process has only recently been developed, and it is uncertain what requirements might be made for the design of the containment pad and for the treated soils to be returned to the excavations. Costs were developed assuming a membrane, but a concrete or an asphalt pad may be required.

Cost Estimate

Capital costs for this alternative include installation and system startup. Table 5-13 presents the estimated order-of-magnitude capital costs for this option. The total estimated capital costs are $588,000. Operating and maintenance costs include labor, utilities, and monitoring of the system performance. Table 5-14 presents the estimated order-of-magnitude operating and maintenance costs for this alternative. The total operating and maintenance costs are $3,028,000.

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Table 5-13

Estimated Order-of-Magnitude Capital Costs for Alternative OS-5 (Low Temperature Thermal Treatment)

Item	Description	Quantity	Unit Cost ($)	Total Cost ($)
1	Design	Lump Sum	100,000	100,000
2	Mobilization	Lump Sum	50,000	50,000
3	Site preparation for thermal treatment (foundation, extra engineering work, connecting utilities)		Lump Sum	50,000
4	Installation of treatment unit		Lump Sum	100,000
5	Startup and trial burn		Lump Sum	100,000
	Subtotal			400,000
6	Administrative (22%)			88,000
7	Contingency (25%)			100,000
	Total			588,000

Table 5-14

Estimated Order-of-Magnitude Operating and Maintenance Costs for Alternative OS-5 (Low Temperature Thermal Treatment)

Item	Description	Quantity	Unit Cost ($)	Total Cost ($)
1	Labor	6,000 hours	50/hr	300,000
2	Health and Safety Equipment	120 days	300/day	36,000
3	Excavation (includes labor)	4,900 yd^3	18/yd^3	88,200
4	Installation of Shoring	9,255 ft^2	7.50/ft^2	70,000
5	Shredding oversized material	500 yd^3	5/yd^3	2,500
6	Thermal Treatment Process (includes labor, utilities, and laboratory analysis)	4,900 yd^3	300/yd^3	1,470,000
7	Backfill excavated areas/regrade/revegetate (includes labor)	4,900 yd^3	15/yd^3	73,500
8	Verification Sampling	60 samples	320/sample	19,200
	Subtotal			2,060,000
9	Administrative (22%)			453,000
10	Contingency (25%)			515,000
	Total			3,028,000

5.4.2.6 Alternative OS-6: Off-Site Disposal/Incineration

Under this alternative, the three areas of soil contamination outside the building would be excavated. The soil would be sent to either a hazardous waste landfill or incinerator depending on whether the excavated soil met the Land Disposal Requirements (LDRs). The excavated areas would be backfilled with clean soil.

Prior to excavation, additional soil samples would be collected to determine the excavation volume. Six test pits would be excavated in Areas 1, 2, and 3 with three samples collected from each test pit for VOC analysis. Excavation of the soils would proceed in the same manner as described in Alternative OS-4. Excavation and transportation would need to be coordinated with the TSD facility. The TSD facility may place restrictions on the characteristics and volume of material it receives during a certain time period. Also, the LDRs in place at the time of remediation would affect this alternative.

The total volume of VOC-contaminated soil to be excavated is estimated at 4,900 yd^3. It was assumed for cost estimating that half of the VOC-contaminated soil would require treatment prior to landfilling. The remaining soil would be landfilled without treatment. Clean granular material would be used to backfill the excavation. Soil samples of every truckload of the excavated material would be collected. Analyses would be performed at an on-site mobile laboratory to determine whether the soil is contaminated at levels greater than LDRs.

Technical Evaluation

Ten samples will be collected from the excavation sidewalls and bottom from each excavation area to confirm that all soils that exceed cleanup goals have been removed. The areas of excavation may be expanded based on these sample results. Confirmatory sampling may indicate that VOC contamination extends underneath the building. Excavation and treatment of any contamination that does extend underneath the building are not feasible.

This alternative is readily implemented, relying on standard construction techniques. Obtaining the necessary landfill and incinerator approvals may take 2 months.

All contaminated soils over action levels would be removed, so long-term operation or maintenance activities would not be required.

Environmental Assessment

The potential risk resulting from contaminants leaching from soil to groundwater would be reduced significantly. Groundwater quality would be expected to improve over current levels because the major source of contamination would be removed.

Human Health

On-site air monitoring would be conducted during excavation of VOC-contaminated soil to determine the level of respiratory and dermal protection required for workers. Air quality would also be measured near the site boundary to monitor potential emissions to the surrounding community. Volatile emissions associated with groundwater treatment would be effectively controlled. Excavated materials would be adequately secured during removal, handling, and shipping activities so that releases would be prevented.

Institutional

This alternative would not result in reduction in toxicity or volume of the waste for the soils that are landfilled. With incineration, the toxicity of the waste would be reduced. A large number of trucks would be required to transport the excavated soil, potentially raising community concerns.

Cost Estimate

Capital costs for this alternative include installation and startup of the system. Table 5-15 presents the estimated order-of-magnitude capital costs for this option. The total estimated cost of this option is $8,094,000.

Table 5-15

Estimated Order-of-Magnitude Capital Costs for Alternative OS-6 (Off-Site Disposal/Incineration)

Item	Description	Quantity	Unit Cost ($)	Total Cost ($)
1	Mobilization/Demobilization	Lump Sum	20,000	20,000
2	Excavation	4,900 yd^3	18/yd^3	88,200
3	Installation of Shoring	9,255 ft^2	7.50/ft^2	70,000
4	Sampling and analysis Prior to treatment	120 samples	250/sample	30,000
5	Off-Site Treatment (including transportation)	2,450 yd^3	1,700/yd^3	4,165,000
6	Off-Site Disposal (including transportation)	2,450 yd^3	400/yd^3	980,000
7	Clean Backfill and Compaction	6,100 yd^3	25/yd^3	152,500
	Subtotal			5,506,000
8	Administrative (22%)			1,211,000
9	Contingency (25%)			1,377,000
	Total			8,094,000

Table 6-4

Summary of Estimated Order-of-Magnitude Capital and Operating and Maintenance Costs

Alternative	Capital Cost ($)	Present Worth of Operating and Maintenance Cost ($)	Total Present-Worth Cost ($)
GW-1: No action	0	0	0
GW-2: Use of additional overburden recovery well and constant pumping of wells W-1 and W-10	99,000	2,023,000*	2,122,000
GW-3: Use of additional overburden recovery wells and pulse pumping of wells W-1 and W-10	173,000	2,123,000*	2,295,000
IS-1: No action	0	0	0
IS-2: Vertical SVE	524,000	251,000	775,000
IS-3: Horizontal SVE	937,000	200,000	1,137,000
OS-1: No action	0	0	0
OS-2: Fence and post warning signs	10,000	6,900*	17,000
OS-3: Vertical SVE	762,000	573,000	1,335,000
OS-4: Ex situ volatilization	813,000	402,000	1,215,000
OS-5: Low temperature thermal treatment	3,616,000	0	3,616,000
OS-6: Off-site disposal/incineration	8,094,000	0	8,094,000

*Based on a 30-year present-worth determination; interest = 6%

6.2 RECOMMENDED CORRECTIVE MEASURES ALTERNATIVES

Three alternatives for groundwater were developed for detailed analysis. Alternative GW-1 (no action) does not meet the corrective measures objectives for groundwater, whereas alternatives GW-2 (installation of additional recovery wells and constant pumping of wells W-1 and W-10) and GW-3 (installation of additional recovery wells and pulse pumping of wells W-1 and W-10) could both meet the objectives depending on extraction well placement. Alternatives GW-2 and GW-3 meet the corrective measures objectives in functionally the same manner. Both act to contain groundwater using recovery wells that would control the shallow, intermediate, and bedrock water-bearing zones. Alternative GW-3 refines this approach by incorporating pulse pumping of the bedrock recovery wells. The existing data suggest that pulse pumping may serve to increase the level of VOCs in the recovered groundwater. This in turn may lead to a reduction in the time required to reduce site groundwater to regulatory standards. Therefore, it is recommended that alternative GW-3 be implemented.

Three alternatives were developed for soils underneath the building. Alternative IS-1 (no action) does not meet the corrective measures objectives for soils, whereas alternatives IS-2 (vertical SVE) and IS-3 (horizontal SVE) would both meet the objectives. Alternatives IS-2 and IS-3 meet the corrective measures objectives in functionally the same manner. With alternative IS-2, vents would be installed from within the building, through the floor. With alternative IS-3, the vents would be installed from outside the building. IS-3 is expected to have less potential impact on the facility operations, but IS-2 is more cost-effective. Therefore, it is recommended that alternative IS-2 be implemented.

The following six alternatives were developed for soils outside the building:

- OS-1 - No action.
- OS-2 - Fence and post warning signs.
- OS-3 - Vertical SVE.
- OS-4 - Ex situ volatilization.
- OS-5 - Low temperature thermal treatment.
- OS-6 - Off-site disposal/incineration.

Alternatives OS-1 and OS-2 do not meet the corrective measures objectives, whereas the remaining alternatives do meet the objectives. Alternatives OS-3, OS-4, OS-5, and OS-6 (with incineration as the disposal option) act to reduce the volume of contaminated material, but alternative OS-6 (with landfill as the disposal option) achieves no reduction of waste volume or toxicity of the soils. Alternatives OS-4, OS-5, and OS-6 all require excavation of the soils, which could potentially volatilize the VOCs in the soils. Additionally, if soil contamination in Areas 1, 2, or 3 extends to and/or underneath the building, the alternatives that involve excavation would become difficult to fully implement and would require SVE. SVE is already the recommended alternative for Area 4 soils underneath the building and could be implemented in Areas 1, 2, and 3, if necessary. SVE is also a well proven technology for VOC-contaminated soils.

Based on these considerations, alternative OS-3 is recommended for soils outside the building.

In summary, the recommended alternatives for the EKCO facility are:

- GW-3 - Installation of additional overburden recovery wells and pulse-pumping of wells W-1 and W-10.
- IS-2 - Vertical SVE.
- OS-3 - Vertical SVE.

APPENDIX A

RESPONSES TO EPA COMMENTS ON THE CMS REPORT

WESTON MANAGERS DESIGNERS/CONSULTANTS

RESPONSES TO EPA COMMENTS ON THE CMS REPORT

As noted in Subsection 1.1.1, the CMS has been revised in accordance with EPA instructions in a letter dated 21 October 1993 (included here as Attachment 1). EKCO disagrees with many of the changes ordered by EPA but has complied with the Agency's instructions for the reasons stated in Subsection 1.1.1. This appendix provides EKCO's response to each of EPA's comments and summarizes the basis for EKCO's disagreement with certain aspects of these comments.

EPA Comment No. 1 (Subsection 1.3.2, Page 1-24, Hydrogeologic Summary)

The first full sentence on this page states that shale and argillaceous sandstone act as barriers to groundwater flow and that variations in permeability occur locally. The following should be added to this sentence: "... and they are not laterally continuous across the site."

Response: The geologic and geophysical logs from all of the borings advanced at the site and in the area surrounding the site, and also available publications on the bedrock geology of northeastern Ohio indicate that Comment No. 1 is incorrect. The RFI cross-sections and fence diagram (Figures 4-1, and 4-19 through 4-24) display the geology across the site. These figures clearly show that the argillaceous sandstone and shale beds are generally flat lying and laterally continuous across the site. In addition, George W. White (1982) describes the bedrock geology in northeastern Ohio as flat lying and generally unfolded with a gentle dip to the south and south-southeast at about 30 feet per mile. RFI cross-sections A-A′ and B-B′ (Figures 4-19 and 4-20) show that a portion of the bedrock has been eroded away at the eastern edge of the EKCO property near bedrock wells R-4 and R-7, but across the site, these layers are laterally continuous.

EPA Comment No. 2 (Subsection 1.3.2. Page 1-24, Second Paragraph)

After the first sentence, include the following sentence: "On-site recovery wells do not have any effect on the deep sand and gravel layer which overlies the bedrock. The flow system in this interval is governed by the OWS wells which pull the groundwater to the north."

Response: All of the groundwater flow data collected in the area of the site clearly show that the first sentence of Comment No. 2 is incorrect as stated and that the second sentence of Comment No. 2 is only true east of wells I-6 and I-9, but not true adjacent to the site. The attached Figures 1 and 2, located at the end of this appendix, are annotated cross-sections that help to illustrate the following rationale:

- The sandstone unit, occurring between approximately 800 and 850 msl, exists beneath the entire site and is the primary water-bearing unit from which production wells W-1 and W-10 pump groundwater.

- The deep sand and gravel is the primary water-bearing unit in the unconsolidated sediments and the sandstone unit is the primary water-bearing unit in the bedrock. Both of these units have relatively higher permeability than their adjacent units above and below. The sandstone unit is in direct contact with the deep sand and gravel unit at the bedrock erosional surface at the eastern edge of the site. At this location, no barrier to groundwater flow exists between these two units, with groundwater able to flow freely from one unit to the other.

- The erosional surface, which is shown in the cross-sections between wells R-4 and I-9 and wells R-7 and I-6, is the only area where these two units are in contact. The sandstone bedrock is not present east of the erosional surface and the deep sand and gravel unit is not present west of the erosional surface. Therefore, the erosional surface is the only area where these two units are in contact and hydraulically connected with each other.

- Hydraulic gradient is the driving force of groundwater flow and causes groundwater to move in the direction of decreasing head (EPA, 1987). The direction of groundwater flow between the sandstone bedrock and the deep sand and gravel can be determined by the hydraulic gradients calculated from wells completed in each of these units. Figure 1 shows that the head is 2.55 ft lower in well R-4 than in well I-9, indicating that if groundwater does flow across the erosional surface it flows from the deep sand and gravel to the sandstone bedrock. The figure also shows that the hydraulic head is decreasing from east to west and, therefore, groundwater flows from well I-8D to wells I-9, R-4, R-2, R-1 and ultimately to pumping well W-10.

Figure 3 is a groundwater contour map that illustrates the interaction of the groundwater in the deep sand and gravel and the sandstone bedrock. This figure shows a linear interpolation of the groundwater elevations of wells completed in the deep sand and gravel and the sandstone bedrock. The extent of the erosional surface was also shown on the map so that it would be easy to see the area where the deep sand and gravel unit is potentially in contact with the sandstone bedrock. The groundwater contours on the figure indicate that at all the areas near the sandstone/deep unit contact the groundwater is being pulled from the deep sand and gravel unit to the sandstone unit by the pumping of wells W-1 and W-10.

Figure 3 also shows while it is evident that adjacent to the site the pumping of the W-wells is pulling groundwater from the deep unit toward the site, farther away from the site near wells I-11 and I-13 the flow system in the deep unit is governed by the OWS wells which pull the groundwater to the north. In summary, any groundwater contamination at the site is being controlled by the W-wells.

EPA Comment No. 3 (Subsection 1.3.3.2, Groundwater Geochemical Summary)

The last statement in the 2nd paragraph is not accurate and it should be replaced by the following: "Groundwater in the deep sand and gravel layer overlying the bedrock is moving away from the site towards the OWS 1, 2, and 3, wells." VOCs that were released into this layer in the past have caused OWS-4 to be shut down and they are moving towards OWS 1, 2, and 3, which have not yet become contaminated."

Response: The preponderance of data collected at the site indicates that the referenced sentence in the CMS is true. No data have been collected that indicate any off-site migration of contaminated groundwater is occurring. In addition, the EPA agreed at the April, 1993 meeting in Chicago that the production wells W-1 and W-10 hydraulically control all groundwater at the site.

The RFI shallow, intermediate, and bedrock groundwater contour maps (Figures 4-26, 4-27 and 4-29) present the groundwater flow conditions for all groundwater that exists at the EKCO site. These three figures clearly show that the EKCO recovery wells significantly affect all groundwater flowing at the entire EKCO facility by drawing it toward the recovery wells and into the on-site treatment system. These figures also demonstrate that the current pumping conditions induce a significant groundwater gradient radially toward the recovery wells, of 15, 8 and 25 ft in the shallow, intermediate and bedrock units, respectively. These horizontal groundwater gradients are significantly higher than necessary to maintain complete capture and clearly demonstrate that the pumping rates are higher than what is needed to prevent off-site contaminant migration.

As stated previously in Response No. 2, the W-wells impact the groundwater in the deep sand and gravel unit at the bedrock/deep unit interface, by drawing water from the deep unit to the sandstone bedrock and preventing any off-site contaminant migration at that interface. Figure 3 shows clearly that the groundwater in the deep unit adjacent to the site is being pulled toward the site by the pumping of the EKCO W-wells.

As discussed in the May 1993 Response to RFI Comments, the EKCO facility has used its on-site W-wells for production since the 1940s to supply the plant with its water needs. The historical pumpage of these wells would have induced similar flow conditions to those presented in the referenced groundwater contour maps and prevented off-site contaminant migration, particularly since no spills have been documented at the site prior to 1979.

The EKCO facility has an effective groundwater recovery system in operation and is significantly exceeding the necessary pumpage to prevent off-site contaminant migration. The preponderance of data indicates that no VOCs have migrated from the sandstone bedrock at the site to the deep sand and gravel unit east of the site, and EKCO has seen no data that indicate otherwise.

WESTON sampled well OWS-4 on 3 September 1987 and had the sample analyzed for VOCs by EPA Method 601. The results were presented in the Interim Measures Report (WESTON, 1988). The sample results indicated that the groundwater contained 4.6 μg/L benzene, 1.2 μg/L trichlorofluoromethane, and 2.5 μg/L vinyl chloride. The sample blank also contained 1.3 $\mu g/L$ trichlorofluoromethane. The source of the relatively low VOC concentrations in well OWS-4 is unknown.

Figure 4 shows that the extent of the glacial valley from which OWS draws its groundwater extends throughout the industrial Massillon area. It can be seen in this figure that within the glacial valley there are abundant potential sources of VOCs to the groundwater. Industrial facilities located within the glacial valley are much more likely sources of the contamination found at the OWS-4 well than the EKCO facility, which is located west of the glacial valley and has a pumping system that pumps significantly more water than is necessary to prevent off-site contaminant migration.

EPA Comment No. 4 (Subsection 1.3.3.2, third paragraph)

Add the following sentence at the end of this paragraph: "However, the leading edge of the plume originating from EKCO within the bedrock aquifer is located under this same point in well R-12."

Response: The source of the VOCs detected in well R-12 is unknown based on available data. However, regardless of the source of the VOCs in well R-12, the contaminants are being pulled from the Price Brothers property to the EKCO recovery wells and are being captured and treated by the ongoing treatment activities at the site.

The Agency has previously agreed (July 1993 EPA RFI comments) that the high concentrations of VOCs detected in well S-12 are a result of a source on the Price Brothers property and located close to well S-12. The relatively low concentrations of VOC in intermediate well I-12 (RFI Table 4-7) would indicate that the VOCs detected in wells S-12 and R-12 are not directly related.

The RFI cross-section Figure 4-22 shows that the overlying low permeable shale and argillaceous sandstone beds which impede downward contaminant migration thin across the Price Brothers property. If other shallow TCE sources exist further north on the Price Brothers property, the thinning of these beds increases the potential for shallow contamination to migrate to the sandstone bedrock. This was discussed in the August 1993 response to EPA RFI Comment No. 14.

EPA Comment No. 5 (Subsection 1.4.1, Page 1-29, EKCO Recovery Wells)

After the first sentence in the fourth paragraph, add the following: "However, the deep aquifer begins at the eastern edge of the EKCO property and is the principal aquifer utilized by the Ohio Water Service."

After the first sentence in the last paragraph in this section, add the following: "VOC contamination migrated into the deep aquifer in the past and this contamination is currently migrating towards the OWS wells to the north."

Response: EKCO agrees with the first sentence in Comment No. 5. A complete subsection of the CMS Report (1.2.3.5) discusses the local groundwater usage and the entire OWS wellfield. This section discusses the pumpage, construction, and location of the OWS wells.

EKCO has not seen any data that support the second sentence of Comment No. 5. If, as requested by EPA, the referenced sentence were to be inserted into the text, it would directly contradict the sentences that precede and follow it. These two sentences read: "In summary, the results of the RFI indicate that VOC-contaminated groundwater is not migrating off-site. Therefore, users of groundwater supplies off-site in the area are not receptors, either actual or potential, for the migration of contaminated groundwater." The responses to Comments No. 2 and No. 3 discuss how the EKCO production wells draw water from the deep sand and gravel unit near the site and prevent any migration of contaminants into the deep sand and gravel unit.

EPA Comment No. 6 (Subsection 2.4.1, Bulleted Objectives)

Add this objective: Achieve regulatory standards (MCLs) for organics found in deep sand and gravel layer which serves the OWS wells in area which are not located on the site, but are adjacent to it and have been impacted by it.

Response: The following objective has been added to the text: Achieve regulatory standards (MCLs) for organics found in any portion of the deep sand and gravel layer (which serves the OWS wells) which are adjacent to the site and have been impacted by it.

Because activities at the EKCO facility have not impacted the deep sand and gravel unit, the OWS wells are not actual or potential receptors for the migration of contaminated groundwater from the EKCO facility.

EPA Comment No. 7 (Subsection 2.4.2., Soils)

Delete the references to the proposed RCRA corrective action levels as these are not expected to be finalized and, furthermore, the soil cleanup level required to protect groundwater will always be lower than those required for direct contact risks.

Delete the second to last sentence in this paragraph which designates a compliance point for MCLs. This doesn't belong in the section on soils and it is not necessarily the Agency's view, therefore, it should be deleted.

Response: These references have been deleted.

EPA Comment No. 8 (Subsection 2.4.2.1, Organics)

Again, delete the references to proposed RCRA corrective action levels.

Response: These references have been deleted.

EPA Comment No. 9 (Page 4-3)

For the short descriptions of each of the last two groundwater alternatives, insert the number of additional extraction wells to be implemented in each.

Also, specify what the treatment will be for the extracted groundwater in this section.

Response: The number of additional extraction wells required for each alternative is now presented in the first line of the descriptions presented on page 4-3.

EPA Comment No. 10 (Subsection 5.3, Detailed Analysis of Groundwater Alternatives)

For both of the groundwater alternatives, GW2 and GW3, much more detail on the proposed configuration of these alternatives is given in this section than in the section on the description of alternatives in Chapter 4. This approach is acceptable in this particular case, because Chapter 5 does launch right into the detailed descriptions of the alternatives. However, to make this transition clear to the reader, appropriate references to these detailed descriptions should be placed back in Chapter 4.

Response: The text now refers the reader to Section 5 for additional detail on the configuration of these alternatives.

EPA Comment No. 11 [Proposed extraction wells in alternatives GW2 and GW3 (shown in Figures 5-1 and 5-2)]

It is not clear that the VOC plume that extends from R-2, through R-10, and through R-12 will be captured by placement of an extraction well at I-2, nor that the groundwater which has escaped the site and caused the shutdown of OWS-4 will be captured by either of these two proposed configurations. Although alternative GW3 did come closer to this than alternative GW2, some flexibility should be considered in proposing extraction well locations to provide for the other remedial objective which is to restore the groundwater in the deep sand and gravel layer that services the Ohio Water Service and allow for OWS-4 to be used again in the future.

Also under both alternatives GW-2 and GW3, the air stripper is in need of new packing material and the discharge lines form the air stripper to the discharge are leaking and allowing *contaminated groundwater to mix with the treated water before discharge. This issue should be addressed in coming up with a final groundwater alternative.*

Also, the maintenance program for the air stripper only states that it would be refilled once every 5 years. A more frequent program of maintaining the air stripping tower is recommended due to the high iron content of the groundwater in this area. This would affect the annual Operation and Maintenance (O&M) costs.

Response: The text now indicates that the proposed extraction well placements will only be finalized after the well rehabilitation IRM has been completed; however, as stated in previous responses, the EKCO site is not impacting the deep sand and gravel aquifer and the OWS wells.

Second Paragraph - Effluent VOC concentrations presented in Table 1-4 do not support the need for new packing material in the air stripper. Additionally, the VOC concentrations in the discharge from the air stripper and at the outfall do not show significant increases and are well below the NPDES limit of 200 mg/L. Maintenance was performed on the sewer that conveys the effluent from the air stripper to the outfall in June 1992, as documented in the text on page 1-32, to prevent contamination of the treated water by untreated groundwater. This maintenance appears to have reduced the VOC levels at the outfall by approximately an order of magnitude.

Third Paragraph - The maintenance program for the air stripper was developed based on the current successful operation of the unit. The air stripper packing was replaced in 1986 and again in 1991. It appears that replacement every 5 years is appropriate.

EPA Comment No. 12 (Extraction Well Shut-down Criteria)

Delete the bottom paragraph on page 5-6 and the rest of this paragraph on page 5-9. Do the same for the bottom paragraph on page 5-14. Both of these paragraphs attempt to stipulate the criteria under which the extraction wells would be shut down and the length of time that monitoring would take place. However, these sections do not cover this issue completely (i.e. frequency), and they deserve more thought than has been given to them here. It is not desirable to include these items in the feasibility study unless a very complete program had been outlined, but it has not. Consequently, this issue will have to be taken up with the Agency as a separate matter once implementation of the groundwater extraction alternatives has begun. What could have been included here in the report would be the estimated clean up time under each of the alternatives.

Response: These paragraphs have been deleted from this document.

EPA Comment No. 13 (Subsection 5.3.2.3, Page 5-10, Human Health Evaluation

The second sentence in this paragraph is not accurate. Alternative GW2 will not prevent the VOCs which are in the deep sand and gravel layer, which have caused the shut down of OWS-4 already, from migrating towards OWS-1, 2, and 3.

Response: See response to Comment No. 11.

EPA Comment No. 14 (Subsection 6.2, Recommended Alternatives)

Change the last five words of the first sentence to: could both meet the objective, depending upon extraction well placement.

Response: The word "would" has been changed to "could."

EPA Comment No. 15 (Subsection 6.1.2, Soils Underneath the Buildings)

Under IS-2, it states that this alternative is strictly a vertical Soil Vapor Extraction, whereas. on page 4-4, the description of this alternative was such that it could include both vertical and horizontal wells. Please make these two sections consistent. It is recommended that you leave yourselves the flexibility to use whichever types of soil vapor extraction wells would work better, possibly even a combination of both vertical wells and horizontal trenches.

Response: Page 4-4 has been edited to more clearly indicate that Alternative IS-2 is strictly a vertical SVE system. IS-3 is strictly a horizontal SVE system. EKCO is still recommending Alternative IS-2 in Section 6.

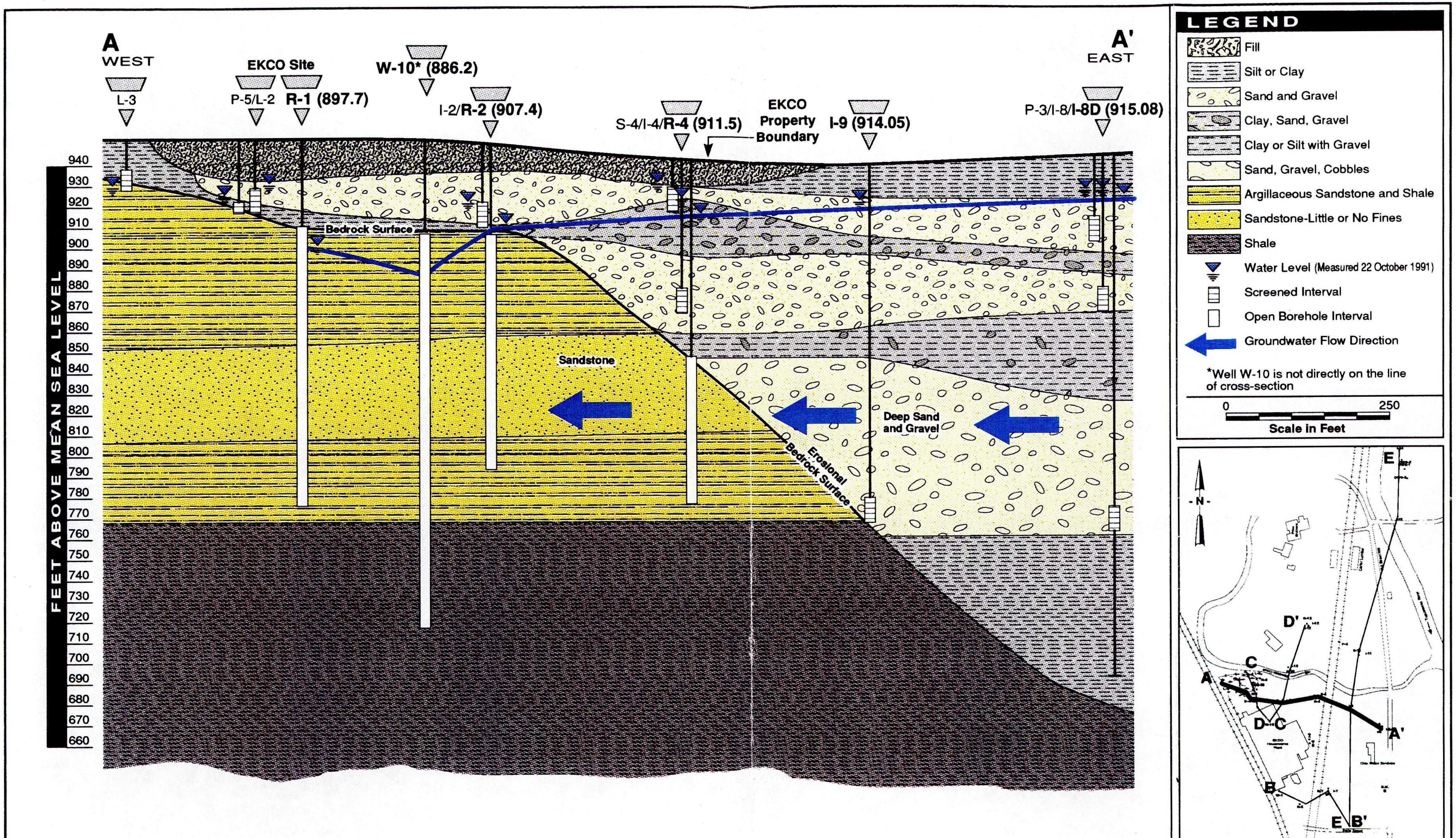


FIGURE 1
ANNOTATED GEOLOGIC CROSS SECTION A-A'
AT THE EKCO HOUSEWARES PLANT, MASSILLON, OHIO

622-8678 11/23/93

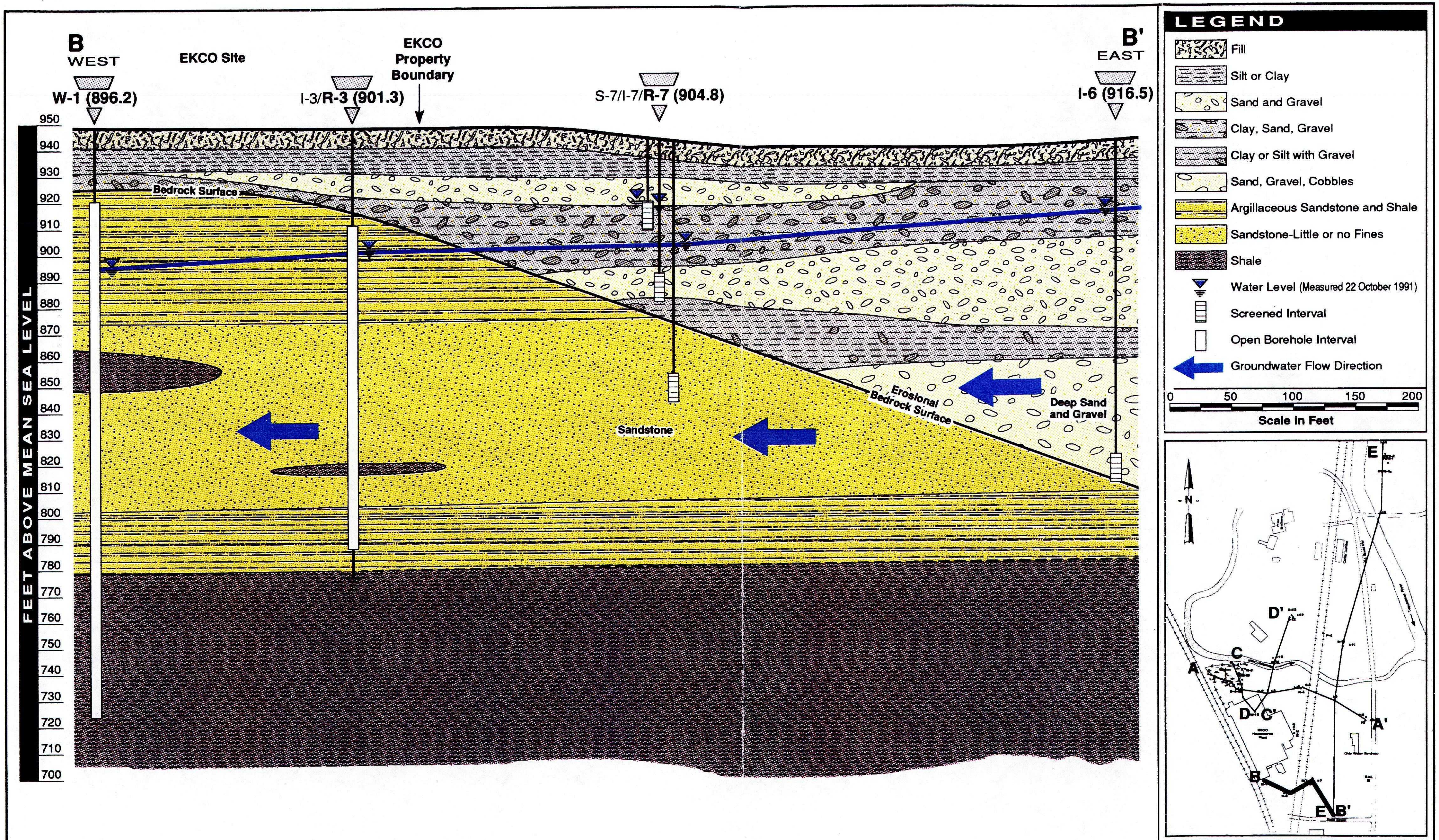


FIGURE 2
ANNOTATED GEOLOGIC CROSS SECTION B-B' AT THE EKCO HOUSEWARES PLANT, MASSILLON, OHIO

622-8679 11/23/93

WESTON

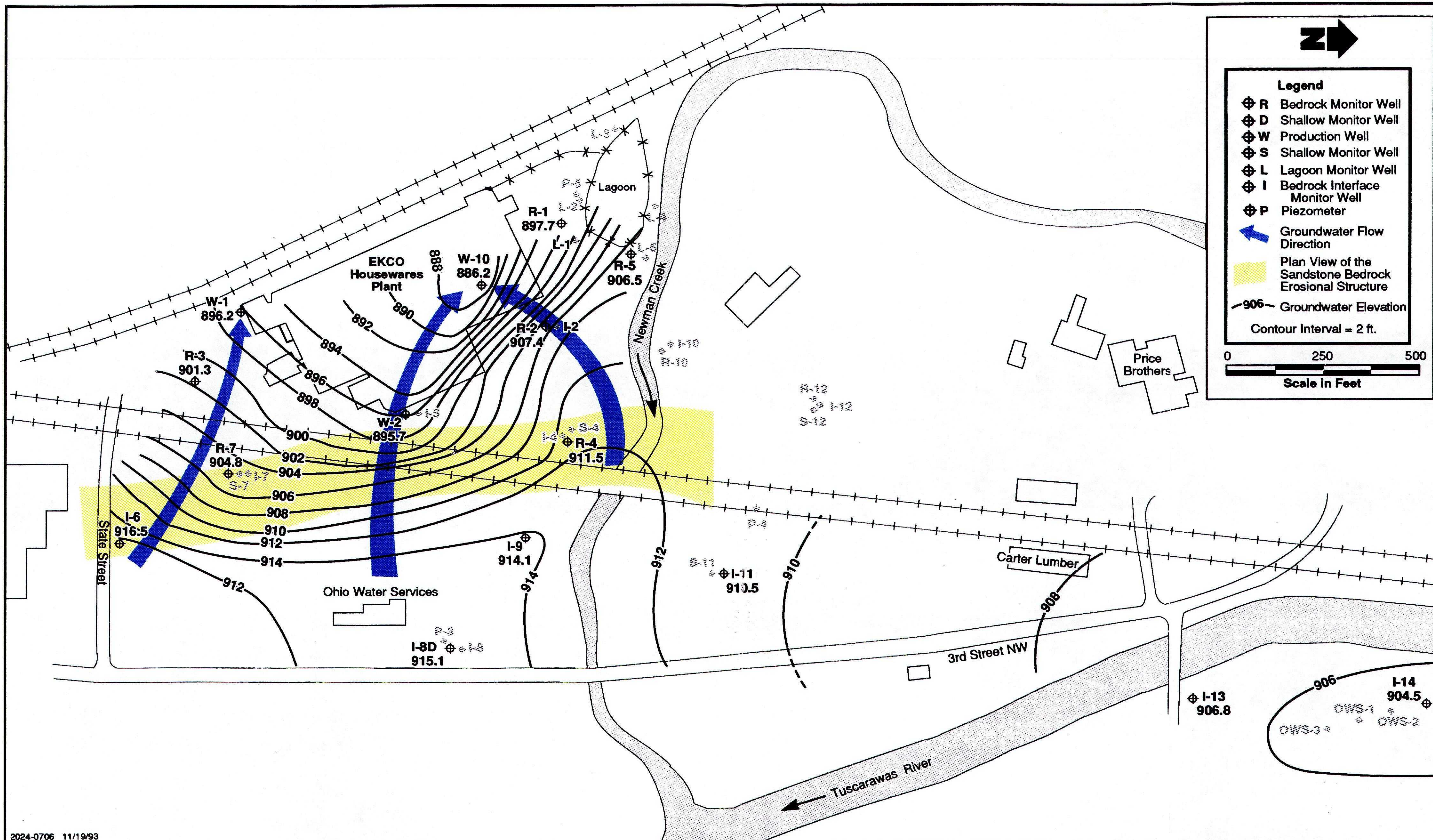


FIGURE 3 GROUNDWATER CONTOUR MAP OF WELLS COMPLETED IN THE DEEP SAND AND GRAVEL WATER BEARING ZONE AND IN THE BEDROCK EKCO FACILITY, MASSILLON, OHIO

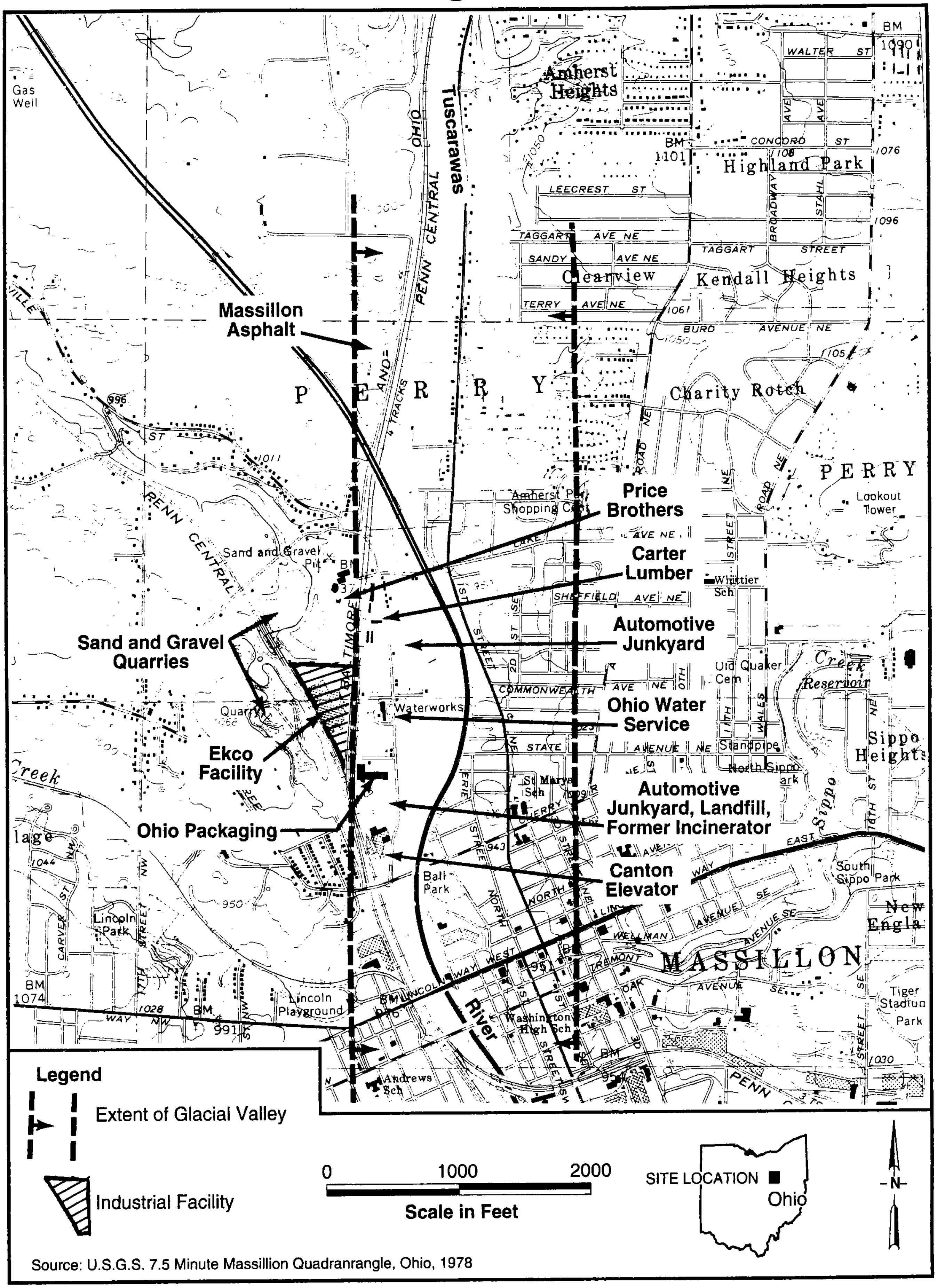


FIGURE 4 EXTENT OF GLACIAL VALLEY AND SELECTED INDUSTRIAL FACILITIES

ATTACHMENT 1

EPA 21 OCTOBER 1993 LETTER

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

OCT 21 1993

REPLY TO THE ATTENTION OF:

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

HRE-8J

Ms. Pat McDonald
American Home Products
685 Third Avenue, 8th Floor
New York, NY 10017

Re: Notification of Disapproval of the draft Corrective Measures Study (CMS) Report for EKCO Housewares, Inc.
OHD 045 205 424

Dear Ms. McDonald:

The United States Environmental Protection Agency (U.S. EPA) has reviewed the draft Corrective Measures Study (CMS) report submitted on September 30, 1993, for the EKCO Housewares facility in Massillon, Ohio. This report is hereby disapproved. The deficiencies and comments on the report are enclosed.

In accordance with Section VI.L. of the Administrative Order on Consent, Docket No. V-W-91-R-01 (Consent Order), please make the required changes to the report and submit the revised document within fourteen (14) days of receipt of this letter. If you should have any questions, please contact Sally Averill at (312) 886-4439.

Sincerely yours,

Joseph M. Boyle

Joseph M. Boyle, Chief
RCRA Enforcement Branch

Enclosure

U.S. EPA COMMENTS ON DRAFT CMS REPORT
Dated September 1993
EKCO Housewares, Inc. -- Massillon, Ohio
OHD 045 205 424

Section 1.3.2 - Page 1-24 - Hydrogeologic Summary

The first full sentence on this page states that shale and argillaceous sandstone act as barriers to groundwater flow and that variations in permeability occur locally. The following should be added to this sentence: "...and they are not laterally continuous across the site."

Second paragraph in same section

After the first sentence, include the following sentence: "On-site recovery wells do not have any effect on the deep sand and gravel layer which overlies the bedrock. The flow system in this interval is governed by the OWS wells which pull the groundwater to the north."

Section 1.3.3.2 - Groundwater Geochemical Summary

The last statement in the 2nd paragraph is not accurate and it should be replaced by the following: "Groundwater in the deep sand and gravel layer overlying the bedrock is moving away from the site towards the OWS 1, 2, and 3, wells. VOCs that were released into this layer in the past have caused OWS4 to be shut down and they are moving towards OWS 1, 2, and 3, which have not yet become contaminated.

Third paragraph, same section

Add the following sentence at the end of this paragraph: "However, the leading edge of the plume originating from ECKO within the bedrock aquifer is located under this same point in well R-12.

Section 1.4.1, page 1-29, ECKO Recovery Wells

After the first sentence in the fourth paragraph, add the following: "However, the deep aquifer begins at the eastern edge of the ECKO property and is the principal aquifer utilized by the Ohio Water Service.

After the first sentence in the last paragraph in this section, add the following: "VOC contamination migrated into the deep aquifer in the past and this contamination is currently migrating towards the OWS wells to the north.

Section 2.4.1 - Bulleted objectives

Add this objective: Achieve regulatory standards (MCLs) for organics found in deep sand and gravel layer which serves the OWS wells in area which are not located on the site, but are adjacent to it and have been impacted by it.

Section 2.4.2 - Soils

Delete the references to the proposed RCRA corrective action levels as these are not expected to be finalized and furthermore, the soil cleanup level required to protect groundwater will always be lower than those required for direct contact risks.

Delete the second to last sentence in this paragraph which designates a compliance point for MCLs. This doesn't belong in the section on soils and it is not necessarily the Agency's view, therefore, it should be deleted.

Section 2.4.2.1 - Organics

Again, delete the references to proposed RCRA corrective action levels.

Page 4-3

For the short descriptions of each of the last two groundwater alternatives, insert the number of additional extraction wells to be implemented in each.

Also, specify what the treatment will be for the extracted groundwater in this section.

Section 5.3 - Detailed Analysis of Groundwater Alternatives

For both of the groundwater alternatives, GW2 and GW3, much more detail on the proposed configuration of these alternatives is given in this section than in the section on the description of alternatives in Chapter 4. This approach is acceptable in this particular case, because Chapter 5 does launch right into the detailed descriptions of the alternatives. However, to make this transition clear to the reader, appropriate references to these detailed descriptions should be placed back in Chapter 4.

Proposed extraction wells in alternatives GW2 and GW3 (Shown in Figures 5-1 and 5-2)

It is not clear that the VOC plume that extends from R-2, through R-10, and through R-12 will be captured by placement of an extraction well at I-2, nor that the groundwater which has escaped the site and caused the shutdown of OWS-4, will be captured by either of these two proposed configurations. Although, alternative GW3 did come closer to this than alternative GW2, some flexibility should be considered in proposing extraction well locations to provide for the other remedial objective which is to restore the groundwater in the deep sand and gravel layer that services the Ohio Water Service and allow for OWS-4 to be used again in the future.

Also under both alternatives GW2 and GW3, the air stripper is in need of new packing material and the discharge lines from the air stripper to the discharge are leaking and allowing contaminated groundwater to mix with the treated water before discharge. This issue should be addressed in coming up with a final groundwater alternative.

Also, the maintenance program for the air stripper only states that it would be refilled once every 5 years. A more frequent program of maintaining the air stripping tower is recommended due to the high iron content of the groundwater in this area. This would affect the annual Operation and Maintenance (O&M) costs.

Extraction Well Shut-down Criteria

Delete the bottom paragraph on page 5-6 and the rest of this paragraph on page 5-9. Do the same for the bottom paragraph on page 5-14. Both of these paragraphs attempt to stipulate the criteria under which the extraction wells would be shut down and the length of time that monitoring would take place. However, these sections do not cover this issue completely (i.e. frequency), and they deserve more thought than has been given to them here. It is not desirable to include these items in the feasibility study unless a very complete program had been outlined, but it has not. Consequently, this issue will have to be taken up with the Agency as a separate matter once implementation of the groundwater extraction alternatives has begun. What could have been included here in the report would be the estimated cleanup time under each of the alternatives.

Section 5.3.2.3 - Page 5-10 - Human Health Evaluation

The second sentence in this paragraph is not accurate. Alternative GW2 will not prevent the VOCs which are in the deep sand and gravel layer, which have caused the shut down of OWS-4 already, from migrating towards OWS 1, 2, and 3.

Section 6.2 - Recommended Alternatives

Change the last 5 words of the first sentence to: could both meet the objectives, depending upon extraction well placement.

Section 6.1.2 - Soils underneath the buildings

Under IS-2, it states that this alternative is strictly a vertical Soil Vapor Extraction, whereas, on page 4-4, the description of this alternative was such that it could include both vertical and horizontal wells. Please make these two sections consistent. It is recommended that you leave yourselves the flexibility to use whichever types of soil vapor extraction wells would work better, possibly even a combination of both vertical wells and horizontal trenches.

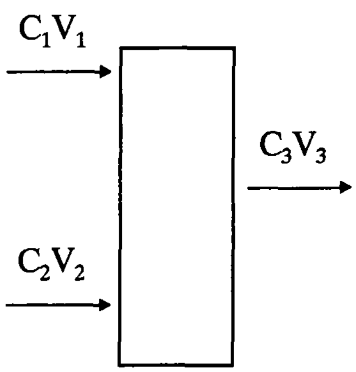
APPENDIX B

CALCULATION OF SOIL CLEANUP GOALS

WESTON
MANAGERS DESIGNERS/CONSULTANTS

CALCULATION OF SOIL CLEANUP GOALS

Partition modeling of contaminants detected in soil borings was performed to calculate soil cleanup goals that would not cause the groundwater to be recontaminated to levels exceeding MCLs. The potential impact of contaminant migration to groundwater was determined using the Summers Model (EPA/540/2-89/057). A leachate concentration that would result in an aquifer concentration at the MCL was calculated using the following mass balance equations:



C_1 = Leachate concentration
C_2 = Upgradient concentration
C_3 = Target groundwater concentration (MCL)
V_1 = Infiltration rate
V_2 = Aquifer flow rate

$$\boxed{V_3 = V_1 + V_2}$$

flow balance
overall mass balance

$$\boxed{\begin{array}{c} C_1V_1 + C_2V_2 = C_3\,(V_1 + V_2) \\ C_1V_1 = C_3\,(V_1 + V_2) \end{array}}$$

overall mass balance
Assume $C_2 = 0$

$$\boxed{C_1 = \frac{C_3\,(V_1 + V_2)}{V_1}}$$

leachate concentration

Infiltration rate ⇒ $\boxed{V_1 \approx 10 \text{ inches/year} * LT}$

where: L = length of groundwater flow under contaminated zone
T = width of groundwater flow under contaminated zone

Ten inches per year is approximately one-quarter of incident rainfall (i.e., 38 inches per year).

Aquifer flow rate ⇒ $$V_2 = \frac{K * i}{\eta_e} * h * T$$

where: K = hydraulic conductivity, ft/day
i = groundwater gradient
η_e = effective porosity
h = aquifer thickness

Once these equations are solved to determine the concentration in the leachate, the concentration in the soil, C_s, can be related to the concentration in the leachate based on equilibrium partitioning. This relationship depends on the specific contaminant organic carbon partitioning coefficient, K_{oc}, and the fraction organic carbon, f_{oc}, and is presented below:

$$C_s = f_{oc} K_{oc} C_1$$

where: C_s = soil concentration

The calculations are presented in the attached table for each contaminant of concern.

B-3

Soil Goals Based on Groundwater MCLs using Partition Coefficients and a Simplified Dilution Model of the Shallow Zone Aquifer
Based on Residential Yard with Fair Grass Cover (HELP Model Infiltration Rate)
For Compounds Found in the Soil at EKCO Housewares, Inc. , Massillon Ohio

Contaminants	Maximum Soil Conc. (mg/kg)	Koc (mL/g) (b)	Water Solubility (ug/L) (b)	Leachate Conc.(Est) (ug/L)	Est. GW Conc. (ug/L)	GW Goal MCL (ug/L)	Soil Goal [MCL] (mg/kg)
Volatiles							
1,1-DCA	0.34	3.00E+01	5.50E+06	755.6	7.0	NA	NA
1,1-DCE	0.14	6.50E+01	2.25E+06	143.6	1.3	7	0.7
1,2-DCE	34	5.90E+01 (c)	6.30E+06	38418.1	354.2	100	9.6
1,1,1-TCA	4 (d)	1.52E+02	1.50E+06	1754.4	16.2	200	49.5
TCE	140 (d)	1.20E+02	1.10E+06	77777.8	717.2	5	1.0
Methylene Chloride	48 (d)	NA	NA	NA	NA	NA	NA
Carbon Disulfide	35 (d)	NA	NA	NA	NA	NA	NA
Toluene	200 (d)	3.00E+02	5.35E+05	44444.4	409.8	1000	488.0
Acetone	380 (d)	2.20E+00	Infinite	11515151.5	106175.5	NA	NA
Chloroform	27 (d)	3.99E+03	8.20E+06	451.1	4.2	100 (e)	649.1
2-Butanone	12 (d)	4.50E+00	2.68E+08	177777.8	1639.2	NA	NA
1,1,2-TCA	21 (d)	5.60E+01	4.50E+05	25000.0	230.5	5	0.5
1,1,2,2-PCE	48 (d)	1.18E+02	2.90E+05	27118.6	250.0	NA	NA
Metals (Total)							
Cadmium	8.34	NA	Insoluble	0.0	0.0	5	NA
Chromium	183	NA	Insoluble	0.0	0.0	100	NA
Lead	1540	NA	Insoluble	0.0	0.0	15 (f)	NA

Notes:
(a) - Assumed concentration.
(b) - Literature Value.
(c) - trans isomer
(d) - 1988 value
(e) - MCL for total trihalomethanes
(f) - Action level at tap

NA - Not applicable/Not available

Dilution Parameters:

Infiltration (in/yr)	10	Aquifer Perm. [K] (ft/day)	1.0
Length of GW Flow Over Contaminated Zone (ft)	100	Aquifer water content [n](%)	15.0
Soil Organic Carbon (%)	2	Aquifer thickness (ft)	30.0
		GW gradient [i] (%)	7.1
		GW velocity (ft/day)	0.5
		Aquifer turnover rate Under contaminated zone (#/yr)	1.7

III C 8E

RFI/CMS Work Plan
for

EKCO Housewares, Inc.
Massillon, Ohio

May 1990

WESTON

MANAGERS DESIGNERS/CONSULTANTS

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SECTION 1

INTRODUCTION

The format and contents of this RCRA Facility Investigation/ Corrective Measures (RFI/CMS) Work Plan are based on the EKCO Housewares, Inc., Massillon, Ohio, site Consent Agreement and the Negotiated Scope of Work. Technical scope was negotiated over a period of approximately 6 months between EKCO Housewares, Inc. (EKCO) and the U.S. Environmental Protection Agency (EPA).

1.1 SITE LOCATION

The EKCO Housewares, Inc. facility is located at 359 State Avenue Extension N.W., Massillon, Ohio, 44648. This facility is located on approximately 13 acres, 500 feet north of State Avenue Extension and 1,500 feet west of the Tuscarawas River in the northwest portion of Massillon, Stark County, Ohio. Figure 1-1 shows the location of the facility on a 7.5-minute USGS Massillon quadrangle map of Stark County. The area surrounding the site is largely urban and industrial. Newman Creek, which flows eastward into the Tuscarawas River, borders the northern boundary of the facility. The Penn Central and Baltimore and Ohio Railroads border the facility to the west and east, respectively. Figure 1-2 shows the layout of the EKCO facility. The plant consists of several buildings comprising a total area of approximately 240,000 square feet. The buildings are subdivided into office space, warehouses, machine shops, coating process lines, and packaging and shipping areas. Figure 1-3 shows surrounding land use classifications (zones). The area indicated as residential to the northwest is presently unoccupied.

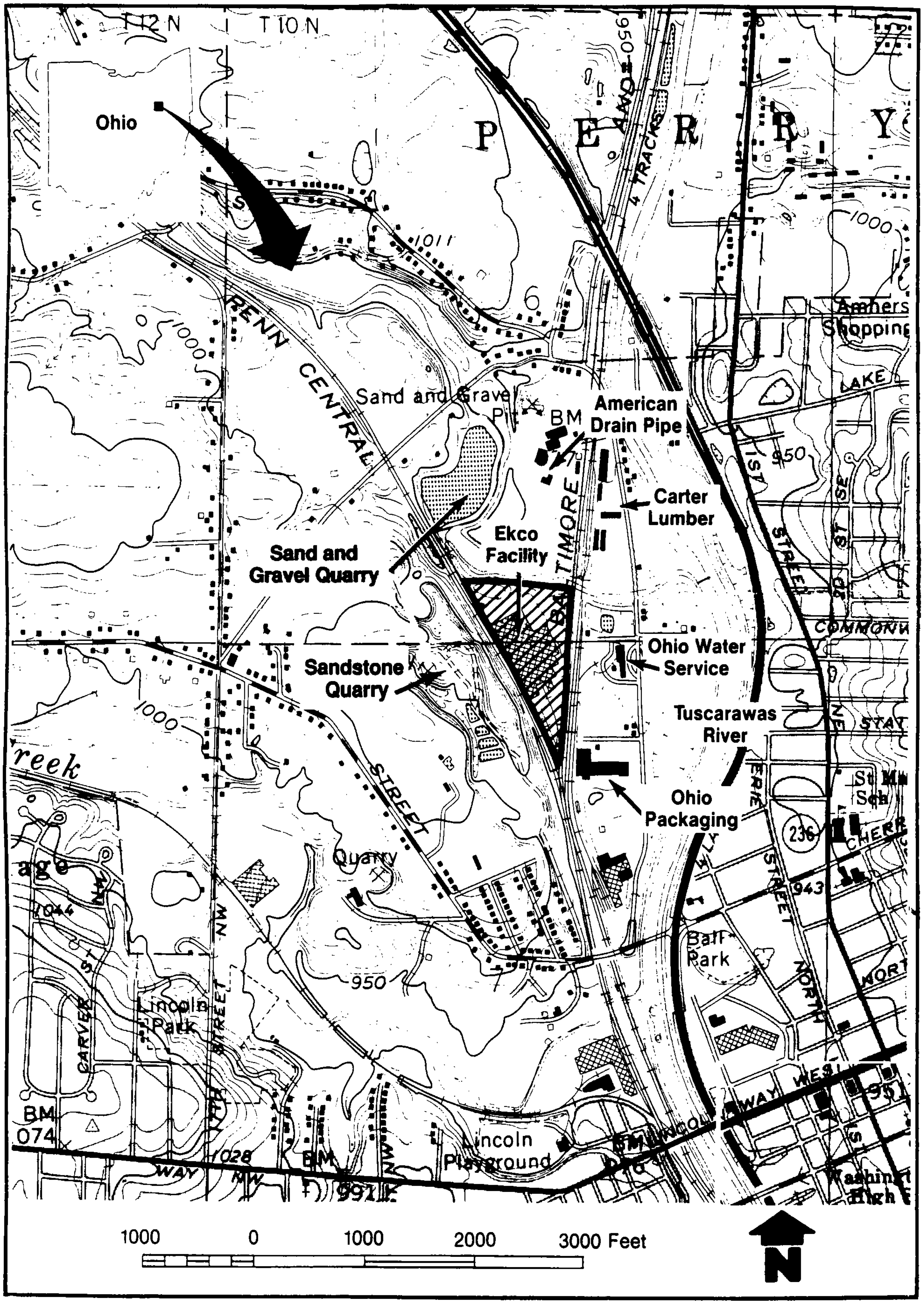

FIGURE 1-1 SITE LOCATION MAP
EKCO HOUSEWARES, INC., MASSILLON, OHIO
(Ref. 7.5 Minute Massillon Quad, Ohio, 1978)

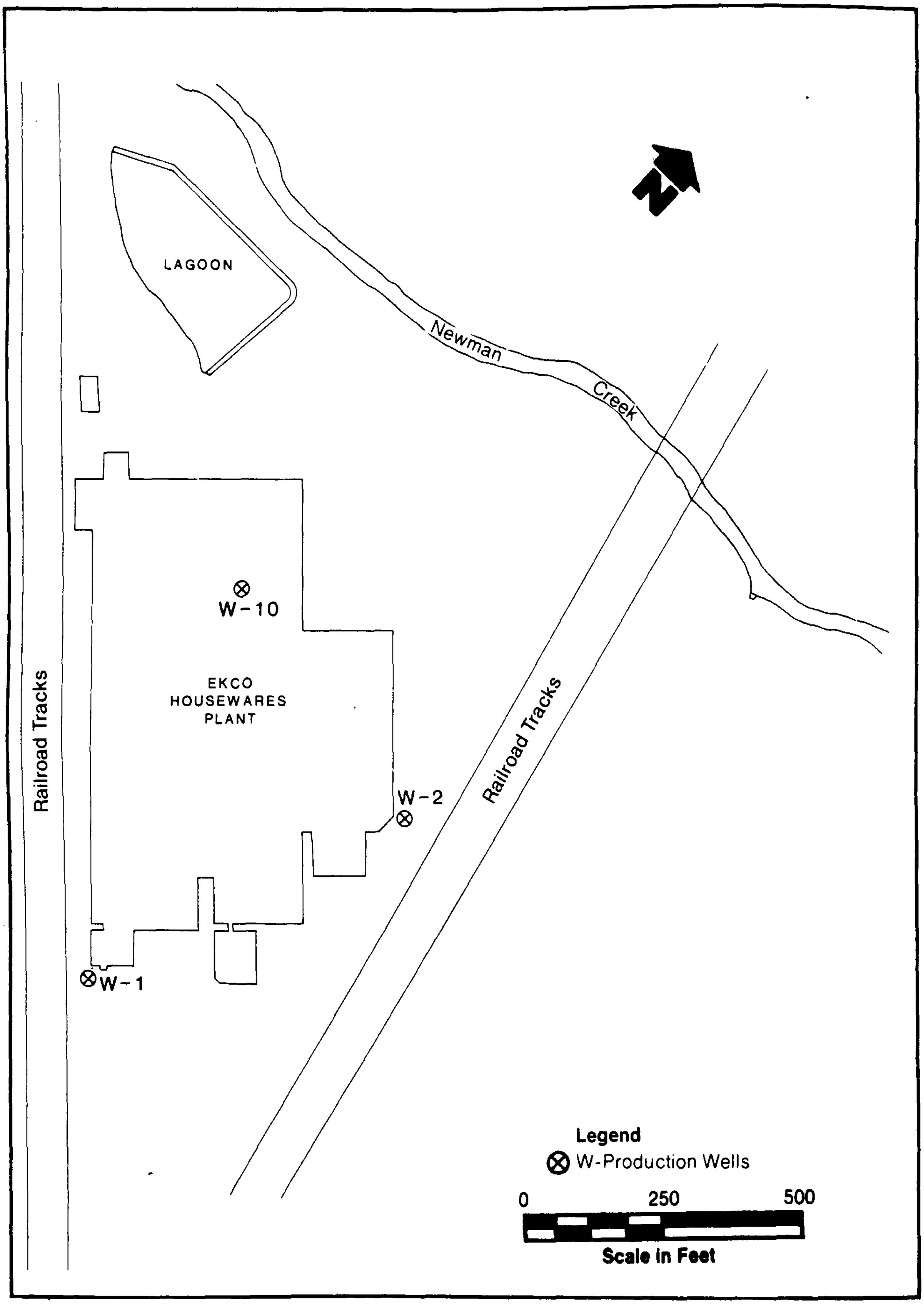

FIGURE 1-2 SITE DIAGRAM OF EKCO HOUSEWARES, INC., MASSILLON, OHIO

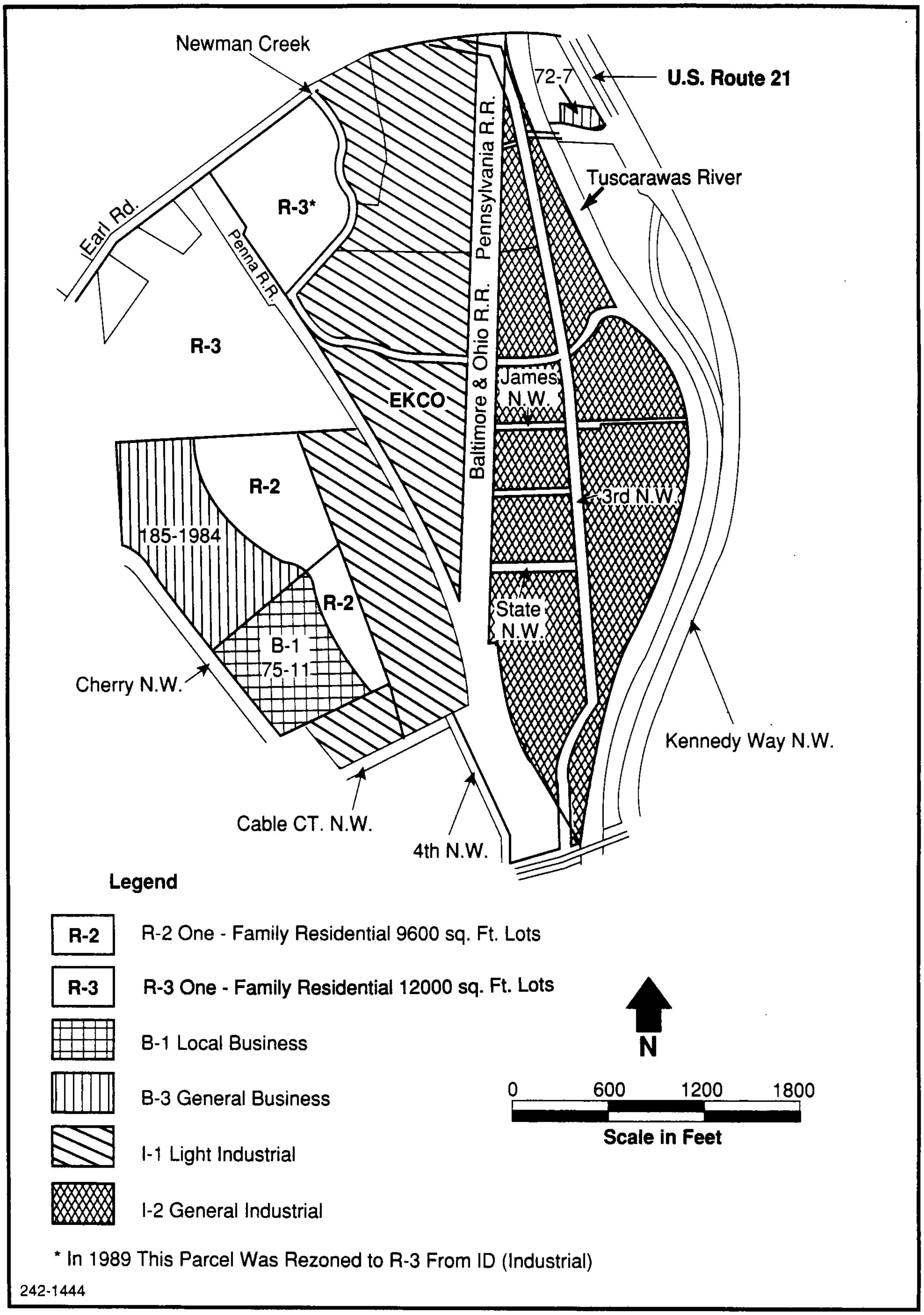

FIGURE 1-3 LAND USE CLASSIFICATION MAP

1.2 SITE HISTORY

1.2.1 Plant Operations

The plant was built around 1900, and in 1945 it began producing aluminum cookware. In 1946, the plant started manufacturing pressure cookers and stainless steel cookware. In 1951, during the Korean conflict, the plant produced 90 mm and 105 mm cartridge cases for the U.S. Government. At present, the plant is engaged in the manufacture of bakeware from metal pressing and coating operations, producing nearly 26 million pans per year and employing about 350 people in a 24-hour per day, 5-day per week operation. A chronology of manufacturing processes at the EKCO facility is given in Table 1-1. A map showing the locations of former and current underground piping at the facility is included as Figure 1-4. Additional detail on previous site operations is available in Section 2 of the "Draft RCRA Closure Plan for EKCO Housewares, Inc.," (WESTON, 1988).

1.2.2 Previous Environmental Studies

Since 1984, various studies and investigations have been performed at the EKCO facility to assess wastewater streams and groundwater quality beneath the site and the lagoon. A detailed summary of activities performed and results is presented in Appendix A, Table A-1. Also, the quality range of the plant effluent discharge into Newman Creek is summarized in Table A-2 of Appendix A. The data from the Groundwater Reclamation Program, which was initiated by EKCO in 1986 in response to contamination detected in a groundwater sample from production well W-1 during National Pollutant Discharge Elimination System (NPDES) permit renewal testing, are summarized in Figure A-1 of Appendix A. In addition, Section 2 of this report describes the current facility conditions based on the most recent investigation, the "Groundwater Quality

Table 1-1

Chronology of Manufacturing Processes at
EKCO Housewares, Inc., Massillon, Ohio

1945	Aluminum cookware manufacturing in line operation.
1946	Pressure cooker manufacturing and stainless steel cookware lines added.
1951	Military production line installed to manufacture 90 mm and 105 mm cartridge cases.
1954	Electroplating line installed.
1967	Porcelain/teflon coating line installed.
1971	Production lines operational consisting of stamping and drawing stainless steel and tin-plated iron material lines; stamping, drawing, and aluminum porcelain enameling line; stamping, drawing, and copper plating stainless steel line.
1978	All plating operations ceased and aluminum porcelain enameling line was discontinued.
1987	Tin-plated iron material stamping, drawing, and coating with silicone resin line in operation.

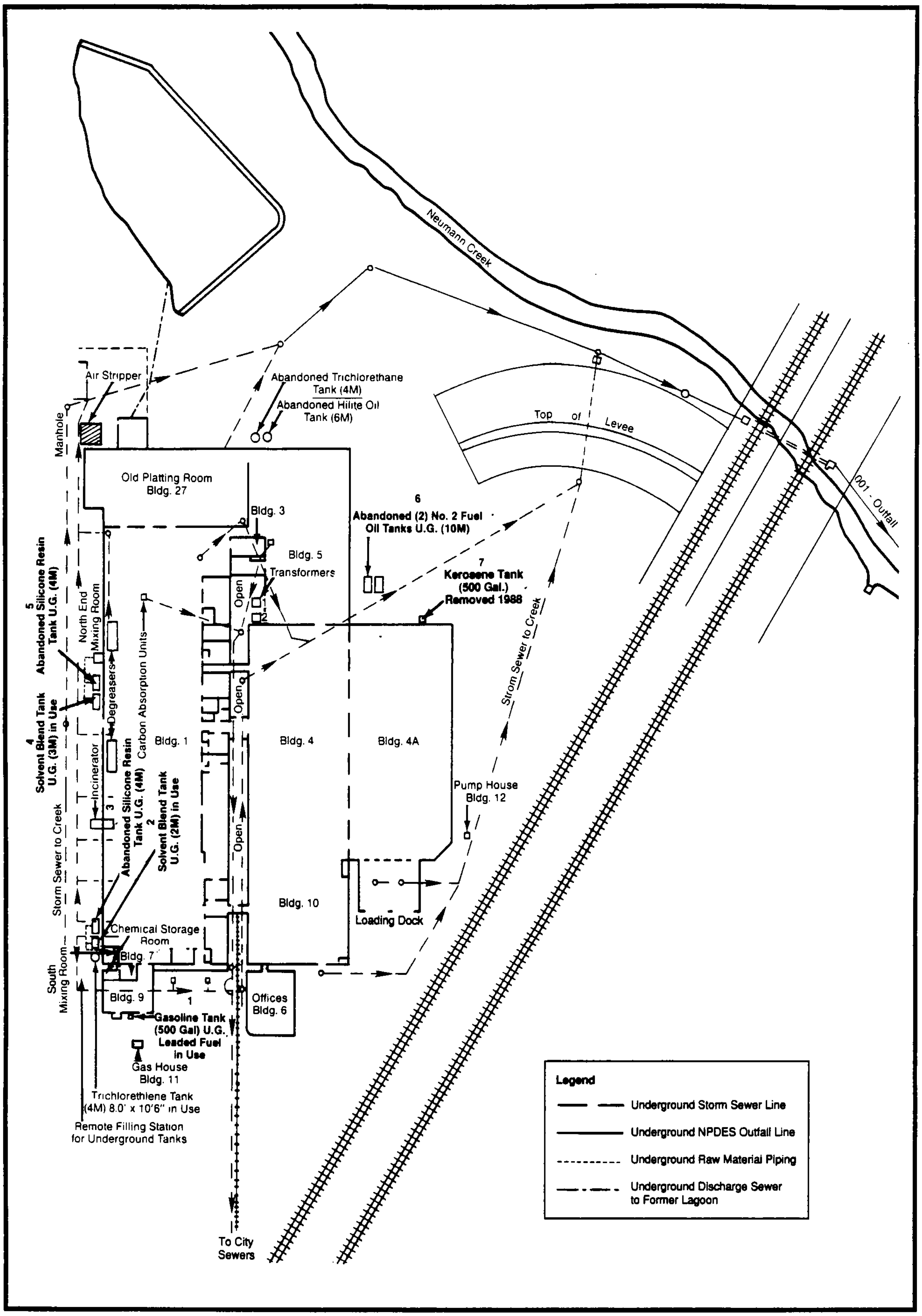

FIGURE 1-4 FORMER AND CURRENT UNDERGROUND PIPING

Assessment Report," (WESTON, May 1988). No enforcement actions were identified in plant records or in conversations with plant managers.

1.3 WORK PLAN OBJECTIVES

The objectives for the preparation of this RFI/CMS Work Plan include:

- Fulfillment of the Scope of Work requirements for describing current facility conditions and presenting the preinvestigation evaluation of corrective measures technologies, referred to as Tasks I and II of the Scope of Work.
- Description of the RFI/CMS activities in sufficient detail to complete all tasks presented in the Scope of Work attached to the Consent Order, Task III of the Scope of Work.
- Outlining a program to collect data and complete an evaluation and selection of the appropriate corrective measures necessary to protect human health and the environment in a cost-effective manner.

1.4 WORK PLAN ORGANIZATION

This RFI/CMS Work Plan follows the suggested format for the RFI/CMS Work Plan described in the U.S. EPA Draft "RCRA Facility Investigation (RFI) Guidance," July 1987, and "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA," March 1988. Section 2 of this Work Plan presents the environmental setting based on available information. Section 3 presents the basis or rationale for the proposed RFI/CMS, including an initial evaluation of available information; the preliminary identification of applicable, relevent, and appropriate regulations; and the preliminary identification of corrective measures technologies. Section 4 describes the tasks to be performed during the RFI/CMS to the extent possible in the planning stage. Section 5 introduces the Quality Assurance Project Plan (QAPP) for performing the RFI/CMS contained in

Appendix C. Section 6 presents the Health and Safety Plan required to perform the field work during the RFI. Section 7 presents the schedule for the completion of the RFI/CMS tasks. Section 8 presents a list of the references used in the development of the Work Plan.

SECTION 2

ENVIRONMENTAL CONDITIONS

2.1 GEOLOGY

2.1.1 Regional Geology

Most of Stark County, Ohio, has been covered by at least two continental ice sheets resulting in variable surficial geologic conditions. The glaciers covered the land surface with a veneer of glacial drift deposits, which range from fine clay particles to boulders. The glacial drift thickness ranges from less than 25 feet to approximately 100 feet. In the areas of buried valleys, this unconsolidated material can exceed 500 feet in thickness (Ohio Department of Natural Resources, 1972).

Melting ice from the receding glaciers produced large quantities of water carrying outwash material. This outwash material, deposited in broadly spread outwash plains and in restricted valleys in the form of kames, eskers, and valley fill, is generally composed of well-sorted, cross-bedded, and horizontally layered sands and gravels.

Underlying the glacial drift and outwash deposits are sedimentary rocks of the Pennsylvanian, Mississippian, and Devonian geologic systems. These bedrock formations dip generally to the southeast at approximately 20 to 40 feet per mile and consist of sandstone and shale with some interbedded coal and occasional thin limestone units (Cross, 1959). Table 2-1 summarizes the generalized stratigraphic sequence for the Middle Tuscarawas River Basin. Figure 2-1 presents the regional surface geology of Ohio, including a cross section.

Table 2-1

Generalized Stratigraphic Sequence in Middle Tuscarawas River Basin

System or Series	Group or Formation	Character of Material	Water-Bearing Characteristics
Quaternary		Clay, silt, and alluvium deposited on the flood plains of the principal valleys.	Generally a poor source of groundwater, owing to limited thickness and absence of coarse materials.
Quaternary Pleistocene		Interbedded and interlensing layers of sand, gravel, and clay deposited in the buried valleys by glacial meltwaters.	Quantity of underground water available depends on character of material and source of recharge. Properly developed wells yield in excess of 1,000 gpm.
		Thick layers of silt and clay interbedded with relatively thin lenses of sand and gravel.	Drilled wells developed in the sand and gravel yield 5 to 15 gpm.
Pennsylvanian	Pottsville	Alternating layers of shale, sandstone, limestone, and coal.	Yields sufficient underground water for farm and domestic needs.
		Thin to thick, coarse-grained sandstone.	Domestic, farm, and industrial supplies are readiy available. Yields of as much as 500 gpm reported. However, regional yield seldom exceeds 15 gpm.
Mississippian		Alternating layers of sandstone and shale.	Farm and domestic supplies are readily developed. If thick shale formations predominate, meager groundwater supplies are developed.

Source: Schmidt, 1962.

flow rate in the fill material can be estimated. Assuming:

Hydraulic Conductivity (K) = 0.1 gpd/sq ft
Effective Porosity (n) = 0.35

and using an intermediate gradient (I) from the range observed in lagoon area of 0.039 feet/foot, the estimated groundwater velocity (v) in the fill is 0.0015 feet/day.

Again applying Darcy's Law, the rate of groundwater flow in the unconsolidated sand and gravel can be estimated. Assuming:

K = 400 gpd/sq ft
n = 0.25

and using I across the facility of 0.045 feet/foot, the estimated groundwater velocity in the unconsolidated sand and gravel is 9.6 feet/day. As coarser deposits have been recognized east of the facility (along the axis of the valley, coarser deposits and higher hydraulic conductivity would be expected), the rate of groundwater flow is probably higher.

Similarly, applying Darcy's Law, the rate of groundwater flow in the bedrock can be estimated. Assuming an effective porosity of 0.10 and using a hydraulic conductivity of 128 gpd/sq ft (K, transmissivity divided by saturated thickness, = 32,000 gpd/feet divided by 250 feet), and the calculated gradient (I) across the facility of 0.04 feet/foot, the estimated groundwater velocity in the bedrock is 6.8 feet/day.

These flow rates are only estimates, and reflect error due to pumping influences. That is, the gradients used are probably significantly influenced (steepened) by the effects of nearby pumping wells, and this artificial influence is carried into the above estimates. No unaffected water surfaces are likely to exist nearby.

SECTION 3

BASIS FOR PROGRAM APPROACH

3.1 CONTAMINANTS OF CONCERN

3.1.1 Types

Based on the past environmental studies performed at the site, a list of the contaminants of concern was developed and is presented as Table 3-1.

3.1.2 Volumes

The total volume of soil contamination at the site has not been precisely calculated at this time. However, an order-of-magnitude estimate of the total VOCs in onsite soils was prepared using the following approach:

- Soil gas survey results from WESTON's May 1989 Groundwater Quality Assessment Report were used to estimate the areal extent of total VOC contamination in soils. Areas indicating soil gas concentrations of 1 ppm and 10 ppm were shown.

- Soil borings, advanced in areas of elevated VOC concentration as determined by the soil gas survey, indicated that the majority of total VOC contamination is located at depths less than 20 feet. The average concentration was less than 1 ppm, and the maximum was 3 ppm. Specifically, in the northern borings the average VOC concentration was 500 ppb, while in the southern borings it was 200 ppb. Distinguishing between these two areas, the northern area with a concentration of 500 ppb is approximately 220,000 sq ft, while the southern area with a concentration of 200 ppb is approximately 30,000 sq ft.

- The average depth of potentially contaminated soils was estimated to 20 feet for these calculations, based on the soil boring results.

- The volumes of soils contaminated with 500 ppb and 200 ppb of total VOCs were therefore calculated to be 4,400,000 cu ft and 600,000 cu ft, respectively.

Table 3-1

Contaminants of Concern

Organic (detected in groundwater and/or surface soils and/or lagoon sludges/subsoils)

Trichloroethylene (TCE)

Trichloroethane (TCA)

Dichloroethylene (DCE)

Dichloroethane (DCA)

Dichlorobenzene

Vinyl Chloride

2-Butanone (Methyl Ethyl Ketone-MEK)

Acetone

Carbon Tetrachloride

Chloroform

Methylene Chloride

Chloromethane

Inorganic (detected in lagoon sludges/subsoils at elevated levels)

Cadmium (total)

Chromium (total)

Lead (total)

- Assuming an average soil density of 110 pounds per cubic foot (lb/cu ft), the mass of total VOCs in the 500 ppb soil volume is 245 pounds, while in the 200 ppb soil volume it is 15 pounds.

This order-of-magnitude estimate indicates a total of 260 pounds of total VOC contamination in 5,000,000 cu ft (185,000 cu yd) of contaminated soils.

3.2 POTENTIAL MIGRATION PATHWAYS

3.2.1 Soils

Soils from the lagoon area and surface soils from the contaminated areas of the site could potentially migrate through soil erosion caused by precipitation runoff and wind (airborne dust). The corresponding potential routes to human exposure include direct contact with soils onsite or sediments offsite; ingestion of soils or sediments; and inhalation of soil particles blown and suspended by wind.

3.2.2 Air

VOCs could potentially emanate from contaminated onsite areas or from the air stripper stack into the air. In addition, soil particles may migrate by means of wind dispersal. The potential route of human exposure from airborne contaminants is inhalation.

3.2.3 Surface Water

Surface water runoff that transects the site and discharges into Newman Creek provides a potential for the transport of contaminants. The corresponding potential routes of human exposure include direct contact, ingestion of surface waters or aquatic life downgradient from the site, and direct contact with surface water through recreational activities.

3.2.4 Groundwater

Groundwater is a potential migration pathway of concern because of the presence of dissolved (aqueous phase) VOCs in groundwater beneath the site, and because groundwater is used in surrounding areas for water supply purposes. However, the degree of concern is limited as a result of the groundwater recovery and treatment measures implemented at the site. That is, relatively high volume pumping of site wells W-1 and W-10 has created a substantial capture area, minimizing the potential for offsite migration of contaminated groundwater. The degree of concern is further limited because nonaqueous phase liquids (DNAPLS) were not detected in any of the 15 wells sampled (I-2, -4, -5, -6; L-1, -2, -3, -4, -5; R-1, -2, -3, -4, -5; D-4-30) for DNAPLS during the groundwater quality assessment. Potential routes of human exposure include direct contact and ingestion of groundwater withdrawn from downgradient wells and inhalation of VOCs from heated groundwater used in homes for bathing, dishwashing, and other household activities.

3.3 POTENTIAL RECEPTORS

Based on the potential migration pathways identified above, the following are the potential receptors:

- Site workers.
- Trespassers entering the site.
- People living near or working at the site.
- Downgradient groundwater users.
- People using Newman Creek for recreational purposes.

3.4 PRELIMINARY IDENTIFICATION OF APPLICABLE STANDARDS

Site-specific remedial response objectives and criteria will be developed in accordance with the requirements of RCRA based on the following:

- Results of the RFI.

* Levels developed from the data analysis of the RFI sampling results (see Subsection 4.2) that should provide adequate protection of human health and the environment.

* EPA requirements.

* Contaminant-specific and location-specific Federal and state applicable regulations and/or standards (ARARs).

* Local public health and environmental concerns.

These criteria will be developed in consultation with EPA and OEPA. The following subsections present the applicable standards that may be considered during the evaluation of the corrective measures alternatives.

3.4.1 Water Quality Standards

3.4.1.1 Federal

It is important to identify applicable and relevant standards during the planning stage of the RFI/CMS process so that they can be considered in the identification of remedial objectives and in developing and evaluating remedial alternatives.

National Interim Primary Drinking Water Standards, established under the Federal Safe Drinking Water Act (SDWA), are promulgated as maximum allowable contaminant levels (MCLs), which represent the maximum allowable levels of selected contaminants in public water systems (40 CFR 141 and 264). MCLs are based on the lifetime exposure for a 70-kg (154-pound) adult who consumes 2 liters (0.53 gallon) of water per day. Interim health-based MCLs have been established by the EPA for various organic and inorganic chemicals. However, under certain circumstances, a waiver of the requirement to meet the regulations can be obtained and a less stringent alternate concentration level (ACL) may be set and approved.

Location-specific regulations promulgated by RCRA would be applicable to the siting of any onsite storage or treatment alternatives. A treatment facility cannot be located within 200 feet of a fault displaced in Holocene time (40 CFR 264.18). If located in a 100-year floodplain, the facility must be designed, constructed, operated, and maintained to avoid wash-out (40 CFR 264.18). In a normal floodplain or lowlands near surface water bodies, action must be taken to avoid adverse effects to minimize potential harm and to restore the site back to its natural state (Executive Order 11988). The Fish and Wildlife Conservation Act provides that any alternative adversely affecting a stream or river also include action to protect fish and wildlife.

Other applicable Federal regulations include 40 CFR Parts 122 and 125 pertaining to the National Pollution Discharge Elimination System (NPDES).

3.4.1.2 State

Federal ambient water quality criteria documents have been published for 65 pollutants listed as toxic under the Clean Water Act (CWA). These criteria are guidelines that may be used by states to set surface water quality standards. These criteria were intended to represent a reasonable estimate of pollutant concentrations consistent with the maintenance of designated water uses; however, states may appropriately modify these values to reflect local conditions.

The State of Ohio regulates water quality through implementation of regulations contained in the Ohio Administrative Code, Title 3745. Specifically, applicable guidelines are found in Chapter 1, which addresses ambient water quality standards, in Chapter 3, which addresses pretreatment requirements and standards for discharges to POTWs, and in Chapter 33, which addresses NPDES permit requirements.

The State of Ohio has not published any standards for groundwater quality. Standards are decided by OEPA on a case-by-case basis. Often the Federal MCLs are the basis for these standards.

3.4.2 Air Quality Standards

3.4.2.1 Federal

The Clean Air Act National Ambient Air Quality Standards are the relevant Federal ambient concentration standards. These standards are regulated through 40 CFR Part 50, the National Primary and Secondary Ambient Air Quality Standards. Other potentially applicable regulations include 40 CFR Part 52, Subpart K, which regulates the approval and promulgation of implementation plans in Ohio.

3.4.2.2 State

The State of Ohio regulates air quality through implementation of regulations contained in the Ohio Administrative Code, Title 3745. Specifically, Chapter 21 addresses emissions of carbon monoxide, photochemically reactive materials, hydrocarbons, and related materials. Chapter 31 addresses the Ohio permit system regulations, and Chapter 35 addresses regulations on air permits to operate and variances.

3.5 PRELIMINARY IDENTIFICATION OF OPERABLE UNITS AND RESPONSE OBJECTIVES

The operable units at the site include the active and inactive solid waste management units (SWMUs). The active SWMUs consist of the transfer and storage facilities for the following wastes or waste materials:

- Still bottoms from the degreaser units' solvent recovery units.

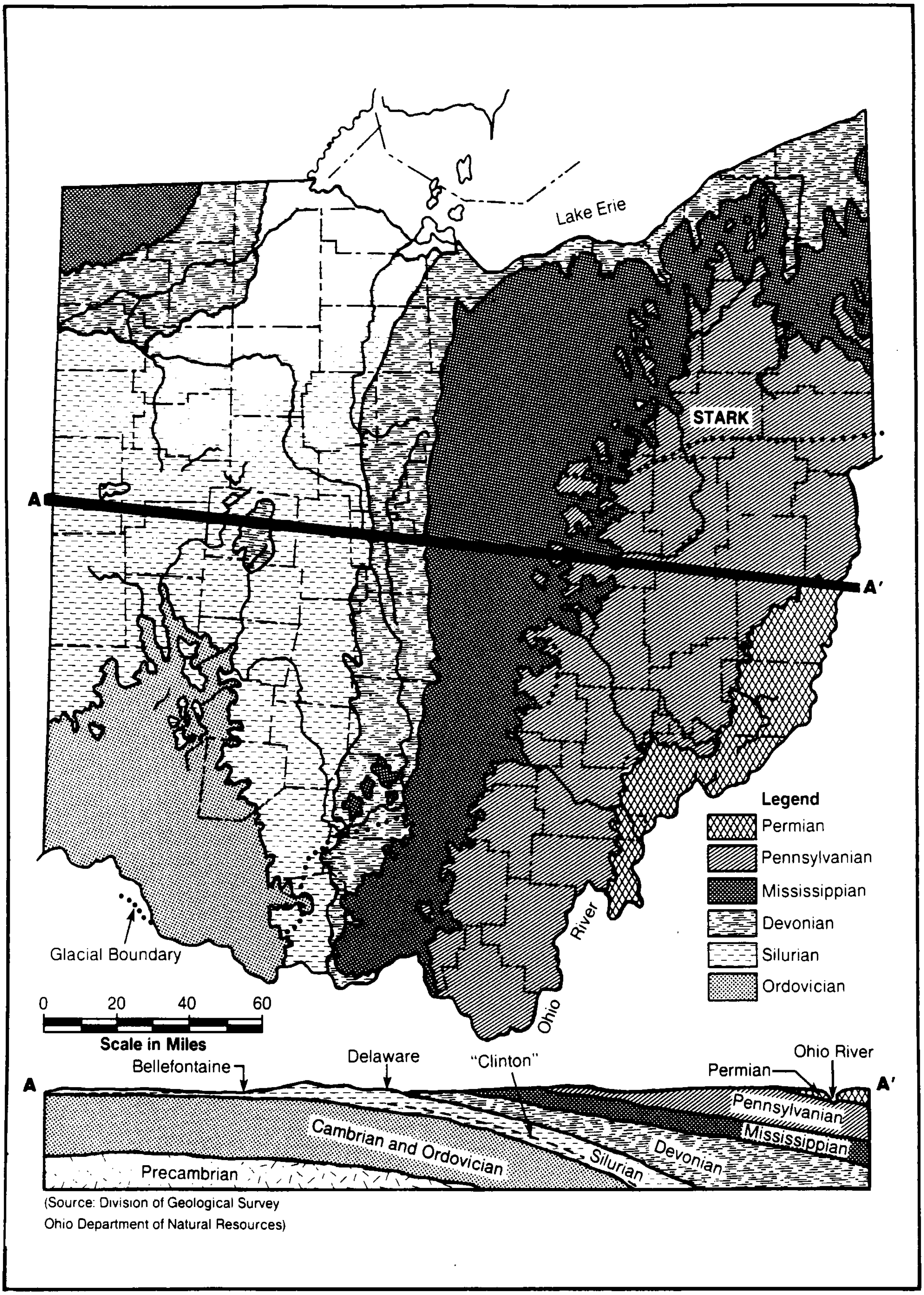

FIGURE 2-1 GEOLOGIC MAP AND CROSS SECTION OF NORTHEAST OHIO

2.1.2 Site Geology

2.1.2.1 Fill Materials

The EKCO facility was constructed on top of fill material that ranges up to approximately 25 feet in thickness, as shown in Table 2-2. The thickness values in Table 2-2 represent the estimated thickness of fill material on the site based upon the well logs. The fill, predating the EKCO facility, was used to level the site and covers a large portion of the EKCO property to the north, east, and southeast of the building. The fill is thickest around the lagoon and southeast of the lagoon.

The fill deposits consist of a wide variety of materials ranging from construction debris to fly ash. At the surface, the fill is a very hard, compacted material with low permeability. The fill is less compacted with depth. Much of the fill area is used as a parking lot. Natural, unconsolidated deposits underlie the fill; based upon current data, fill deposits are not in contact with bedrock.

2.1.2.2 Unconsolidated Deposits

Directly underlying the fill materials are unconsolidated deposits of variable thickness. The unconsolidated deposits are primarily glacial outwash consisting of medium sands and gravels with some interbedded silts and clays.

As seen in Figures 2-2 and 2-3, the unconsolidated deposits vary in composition both vertically and horizontally. This variation causes significant inconsistencies in vertical and horizontal permeability.

The unconsolidated deposits thicken on the site from west to east, ranging in thickness from 4 feet at SB-11 to 150 feet in monitor well I-6. To the west (offsite), the unconsolidated

Table 2-2

Estimated Thickness of Fill Material

Well Number	Fill Thickness (FT)
I-2	0 - 5
I-3	5
I-4	0 - 5
I-5	17
I-6	7
I-7	7
I-8	0 - 3.5
L-1	17
L-2	22
L-3	0 - 3.5
L-4	0 - 3
L-5	0 - 7
P-3	0 - 3.5
P-4	0 - 3
P-5	22

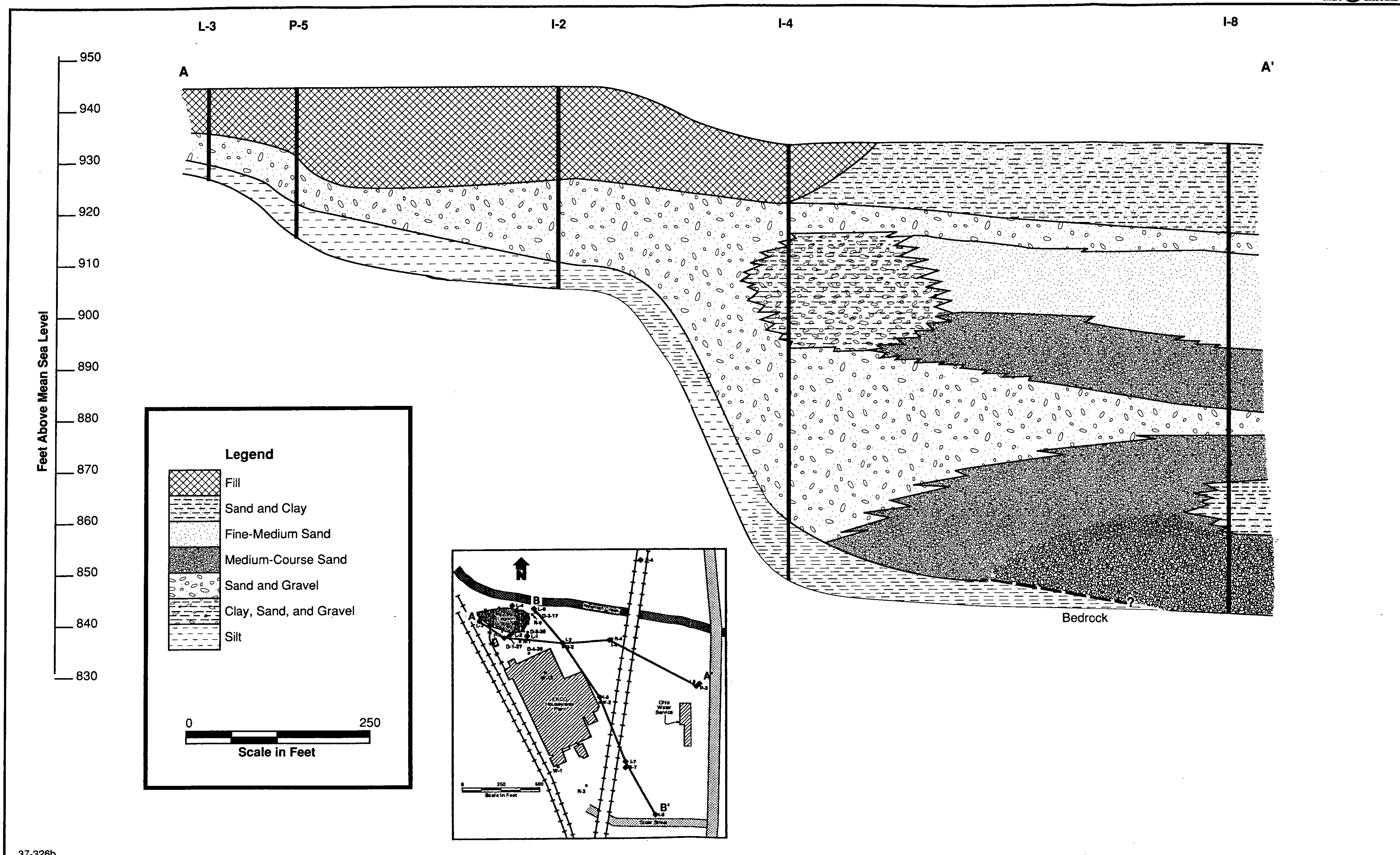

FIGURE 2-2 GEOLOGIC CROSS SECTION A-A' AT EKCO HOUSEWARES PLANT, MASSILLON, OHIO

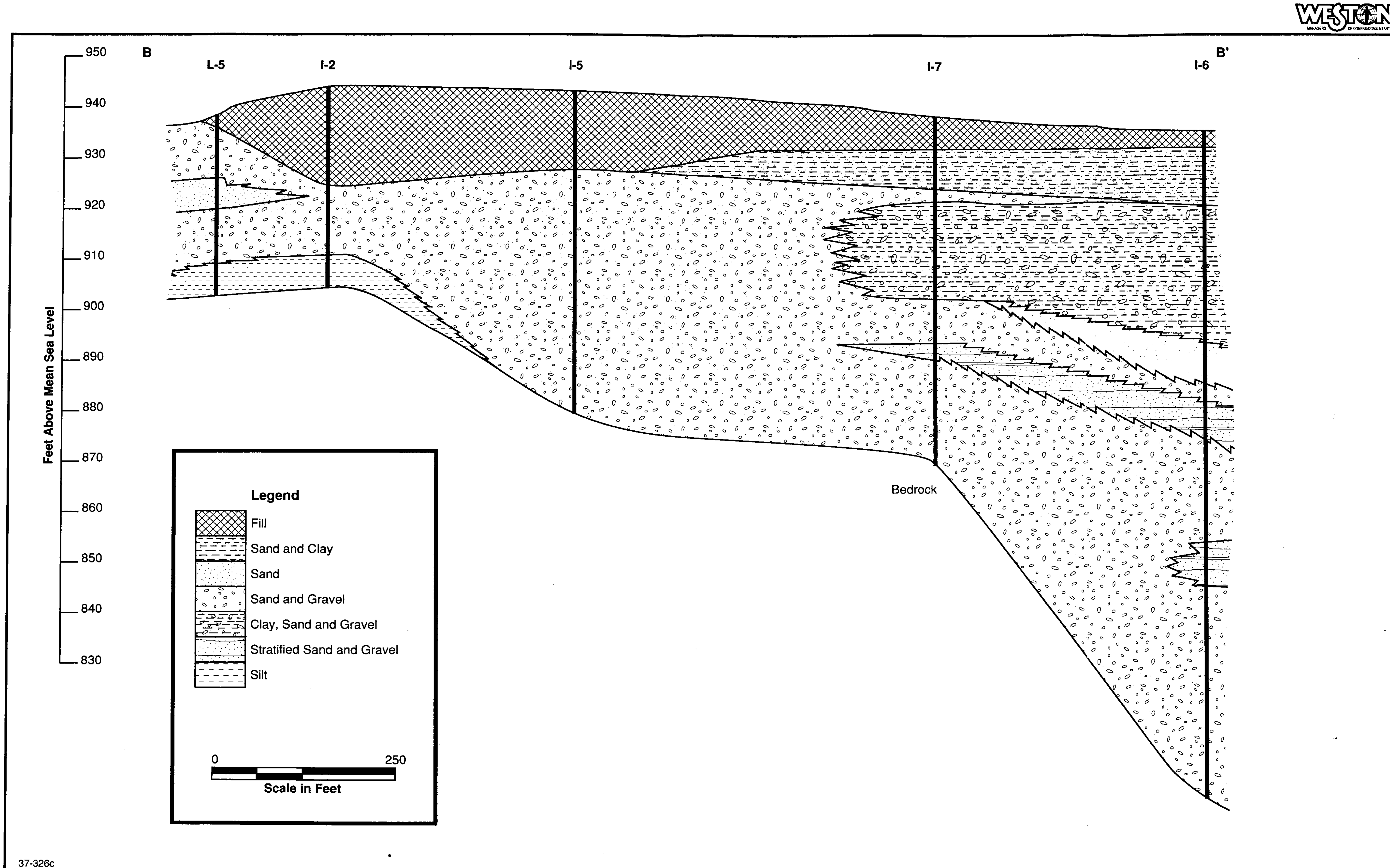

FIGURE 2-3 GEOLOGIC CROSS SECTION B-B' AT EKCO HOUSEWARES PLANT, MASSILON, OHIO

deposits become progressively thinner, reaching zero thickness at the bedrock subcrop approximately 200 feet west of the site. To the east, the deposits thicken toward the Tuscarawas River.

2.1.2.3 Bedrock

Directly underlying the unconsolidated deposits is interbedded sandstone and shale bedrock. The EKCO site lies on a bedrock geologic high (bedrock slopes away in three directions) that slopes to the east and northeast at approximately 16 degrees. The slope of the bedrock surface, based upon boring logs, is graphically represented in the bedrock surface contour map presented as Figure 2-4.

2.2 HYDROGEOLOGY

2.2.1 Regional Hydrogeology

The western portion of Stark County lies within the Middle Tuscarawas River Basin. The units capable of providing sufficient quantities of groundwater to domestic, commercial, and municipal wells underlying this basin include the unconsolidated deposits of sand and gravel and the consolidated layers of sandstone, shale, limestone, and coal. Yields may range from less than 1 gallon per minute (gpm) from clay and shale deposits to more than 1,000 gpm from thick, permeable sand and gravel deposits (Schmidt, 1962). The generalized stratigraphic table (Table 2-1) briefly describes the physical and water-producing characteristics of the units within the Tuscarawas River Basin. Figure 2-5 illustrates the availability and yield of groundwater in the western portion of Stark County.

The outwash deposits beneath the flood plain of the Tuscarawas River have the greatest potential for the development of large groundwater supplies in this basin. Yields from properly developed wells in this unit range from 500 to more than 3,000

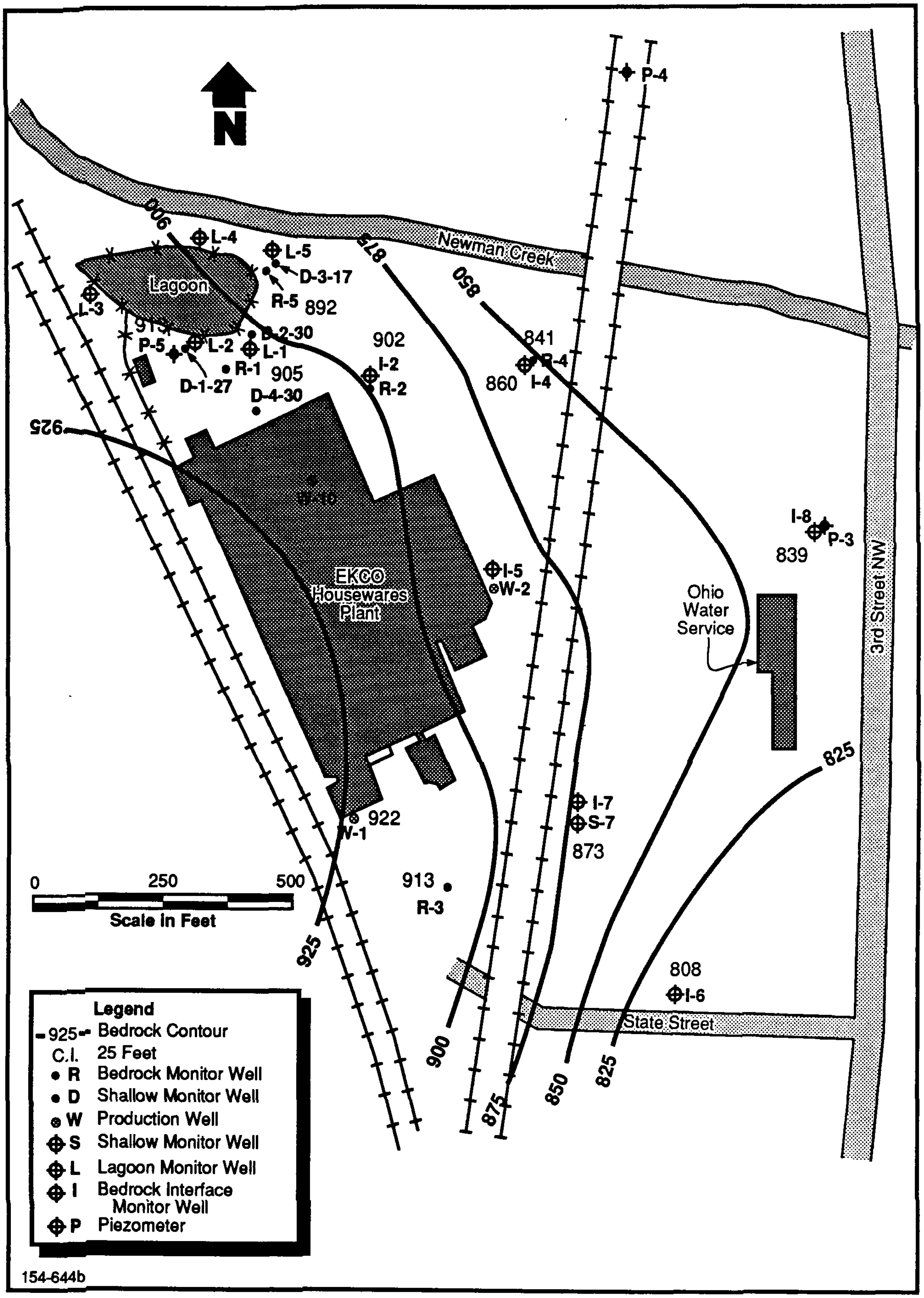

FIGURE 2-4 BEDROCK SURFACE CONTOUR MAP

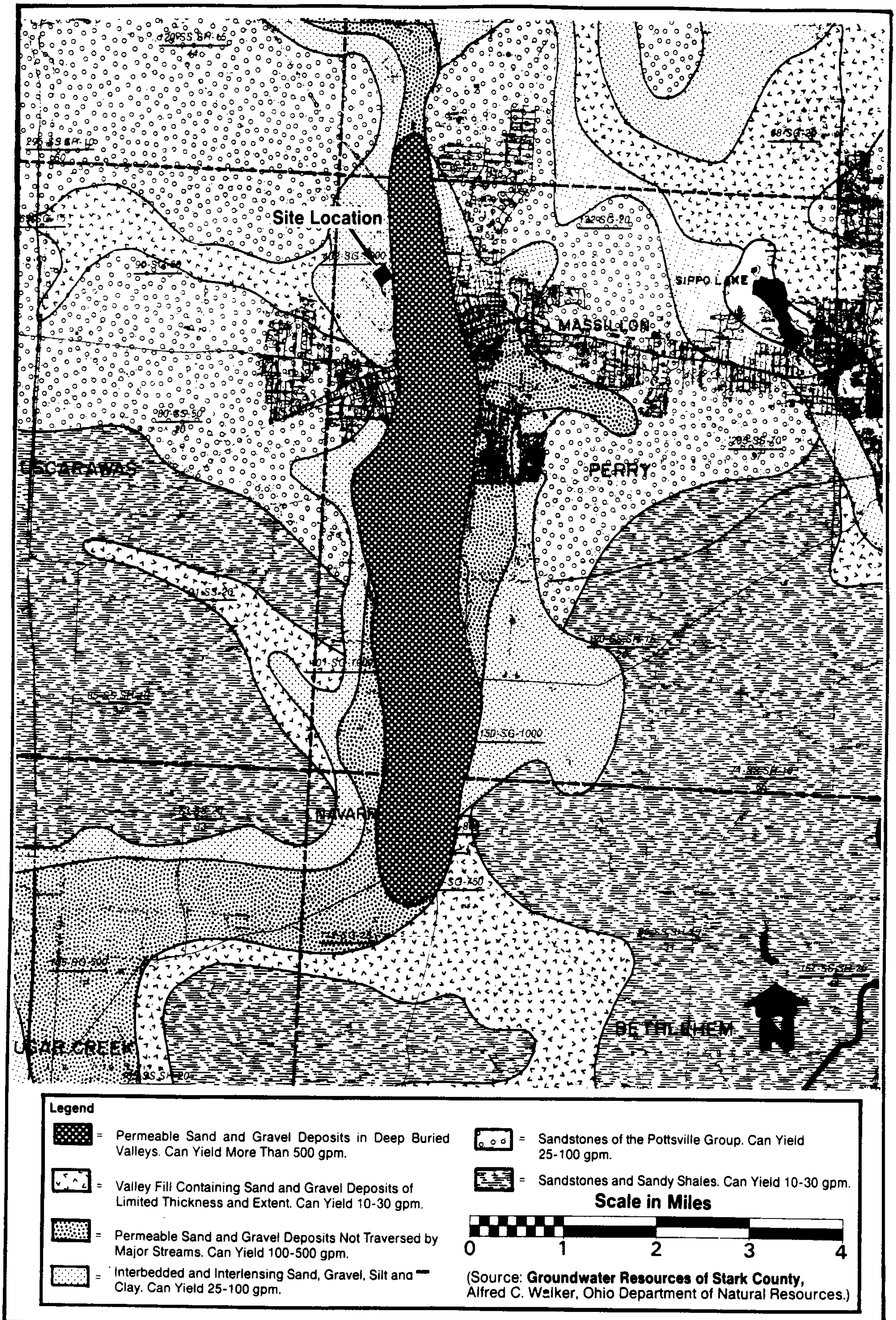

FIGURE 2-5 GROUNDWATER RESOURCES OF MASSILLON, OHIO

gpm. The majority of these wells are developed at depths less than 160 feet (Schmidt, 1962).

Many of the tributaries to the Tuscarawas River are also underlain by thick outwash deposits composed of predominantly clay interbedded with layers of fine sand and gravel. Portions of these tributary valleys are filled with as much as 270 feet of unconsolidated deposits (Schmidt, 1962). But, because of the predominance of clay, the average yield of these deposits is less than 25 gpm, and water wells are typically drilled through these unconsolidated deposits to the underlying bedrock.

The bedrock underlying the glacial deposits in the basin consists of interbedded, thin to thick layers of sandstone, shale, coal, and occasional limestone. All of these are part of the Pottsville Group of Pennsylvanian age. Due to the vertical variations in lithology, and hence permeability, within the Pottsville Formation in the area, groundwater wells reportedly range in depth from 46 feet to 500 feet. It has been reported that yields of groundwater range from less than 1 to more than 500 gpm (Schmidt, 1962). The average domestic well is 170 feet in depth and yields about 8 gpm. Yields of commercial and municipal wells developed in the sandstone units of the lower Pottsville Formation are reported to range from 25 to 100 gpm (Walker, 1979).

2.2.2 Site Hydrogeology

Site hydrogeologic conditions, based upon the findings of the Phase I and II efforts, are described below. The discussion has been subdivided into the following topics:

- Hydrogeologic system.
- Groundwater flow.
- Groundwater gradients.
- Interface dewatered zone.

2.2.2.1 Hydrogeologic System

For the purposes of this report, the hydrogeologic system at EKCO has been subdivided into three interconnected zones: the fill, the unconsolidated glacial deposits, and the bedrock zones. Each of these zones has unique hydraulic properties, and each is affected by the EKCO and Ohio Water Service (OWS) pumping in different ways and to a different extent.

A large portion of the EKCO site is covered with up to 25 feet of fill material. The fill has a significant effect on groundwater flow at the site. Based upon available soil borings and well logs, the fill consists of a variety of fine-grained materials (such as fly ash) that typically have relatively low permeability, being restrictive to both vertical and horizontal groundwater flow. Most of the fill is highly compacted, further inhibiting the movement of groundwater.

Higher water levels were observed in wells screened in the low-permeable fill and native silt lenses (the lagoon wells, L-1 through L-5) than in wells screened in the more permeable glacial sands and gravels. The resulting relatively steep slope of the water surface is typical of low-permability sediments. In addition, this difference in hydraulic head is probably compounded by the pumping effect of the EKCO and Ohio Water Service production wells.

The depth to water varies significantly in the five lagoon wells. The depth to water ranges from a low of 8.57 feet in lagoon monitor well L-4 to a high of 25.49 feet in lagoon monitor well L-1. The saturated thickness in the lagoon area also varies significantly, due to changes in water elevations and considerable changes in bedrock elevation. Saturated thicknesses range from less than 1 foot in L-3 to 37.3 feet in L-5.

Based on available well logs and soil borings, the entire EKCO property is underlain by unconsolidated glacial deposits. These deposits thicken from west to east, extending from approximately 200 feet west of the site to past the Tuscarawas River, 2,000 feet east of the site. The deposits are relatively thin south of the plant (in the parking lot area), with an average thickness of approximately 31 feet.

Because of the interbedded silts and clays, the glacial deposits exhibit permeability that varies both horizontally and vertically. Despite this heterogeneity, the glacial deposits as a whole represent a high water producing zone. For example, the OWS production wells are screened within these deposits; records indicate single well yields of up to 2,800 gpm less than one-half mile north of the EKCO facility in these wells.

The bedrock zone, directly underlying the unconsolidated zone, underlies the entire EKCO plant at varying depths, ranging from 4 feet to the west to 130 feet to the east at the site. Since no site wells have been drilled through the entire productive zone within the bedrock, the total saturated thickness is unknown. However, at least 200 feet of saturated rock exists locally, as W-1 was drilled 200 feet into the bedrock, with saturated conditions reportedly existing at the bottom of the borehole (based upon the driller's record contained in Appendix B).

The bedrock zone is composed of interbedded layers of sandstone and shale. Available well logs indicate that the shale layers may be discontinuous from well to well. As shales are typically less permeable than sandstone, shales may locally separate flow. Such local separation of flow was supported by the aquifer test data, as similarly constructed bedrock wells in different areas responded differently, yielding a wide range of calculated transmissivities and storativities. Calculated values for transmissivity and storativity in the bedrock zone (from all five bedrock wells R-1 through R-5) ranged from 12,000 gallons per day per foot (gpd/foot) and 0.0001 to 68,000 gpd/foot and 0.002, respectively. These storativity values are within the typical range of a confined and an unconfined aquifer, indicating the presence of a partially confined aquifer in the area of the pumping well.

2.2.2.2 Groundwater Flow

Three hydrogeologic zones underlie the EKCO site, and each of the three zones has significantly different hydrologic properties and therefore significantly different groundwater flow patterns.

The first zone, consisting of fill material, is thickest north of the plant near the lagoon. A considerable amount of native fine-grained silt and clay also exists around this area. Five wells (L-1 through L-5) in this area, located in a relatively small area to serve as RCRA compliance wells, were used to evaluate the groundwater flow in the fill zone. Due to the lack of additional reliable shallow fill wells on the site, mapping the flow in this zone was restricted to the five lagoon wells.

Figure 2-6 is a groundwater contour map utilizing water levels measured 10 August 1988 in the five lagoon wells. Immediately north of these wells is Newman Creek, which flows to the east. Quite often in this type of environment, with a shallow water table system adjacent to a stream, groundwater flow is toward the stream. However, in this case, as can be seen in Figure 2-6, groundwater flow is away from the creek and toward the EKCO plant. This may be due to the continuous pumping of the EKCO recovery wells. There is a fairly substantial head loss (7.36 feet) from L-4 to L-1, indicating a significant flow component toward L-1. These data suggest that any shallow groundwater in the area of the lagoon, at the screened interval of the five lagoon wells, is likely traveling toward the site and is

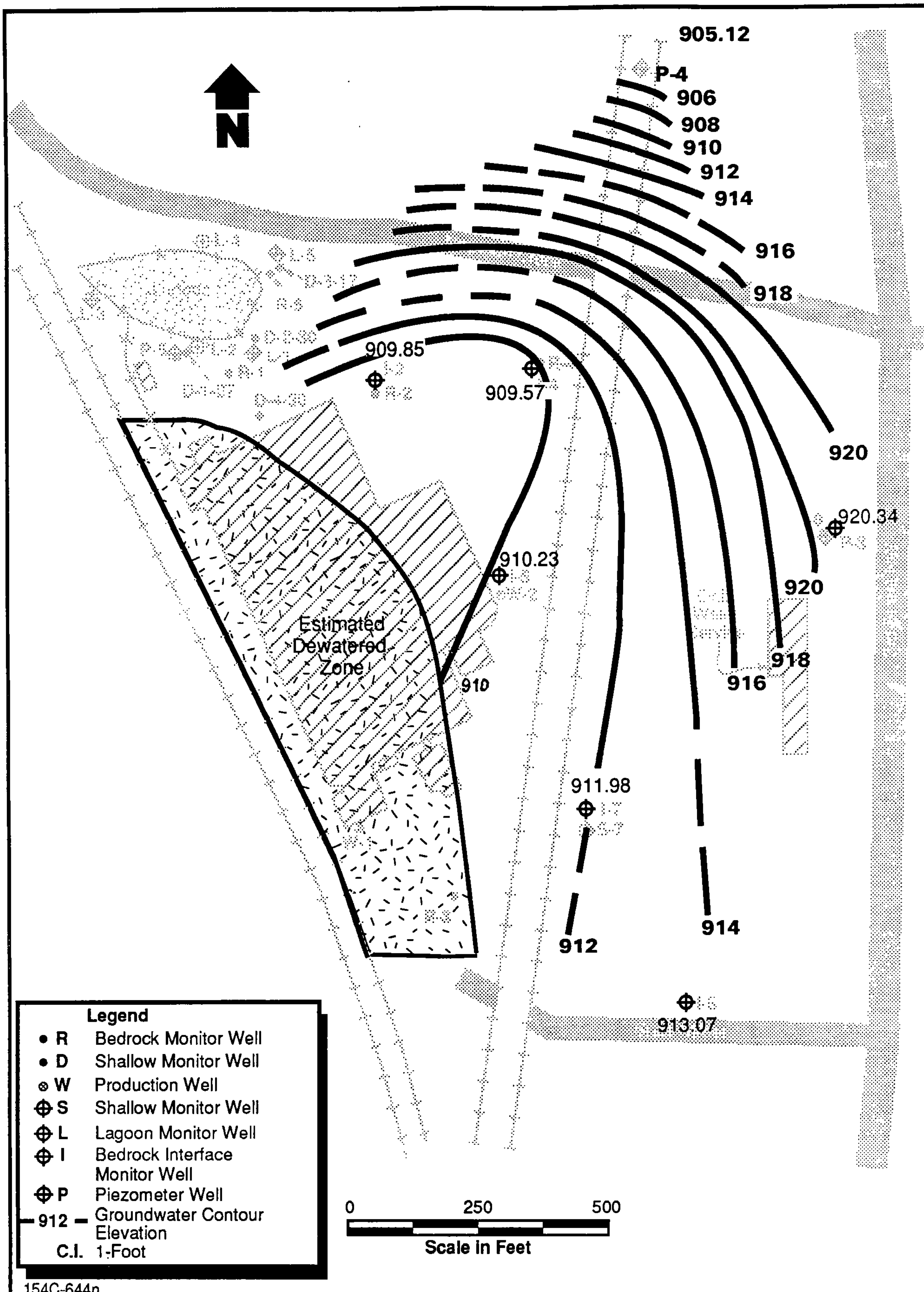

FIGURE 2-6 GROUNDWATER CONTOUR MAP FOR INTERFACE

controlled by the EKCO recovery system. The flow direction has been confirmed in numerous measurements over an 18-month period.

Six interface wells, (I-2, I-4, I-5, I-6, I-7, and I-8) were used to evaluate groundwater flow in the unconsolidated zone. These wells were screened at the bottom of the unconsolidated material at the unconsolidated/bedrock interface.

Figure 2-7 is a groundwater contour map utilizing water levels measured 10 August 1988 in the six interface wells and piezometer P-3. The contours suggest drawdown in the plant area toward the recovery wells, and, north of the plant area, toward the OWS wellfield. The divide between the two slopes may correspond with (and be enhanced by) percolation out of Newman Creek. Additional data obtained during the RFI will allow more detailed evaluation of groundwater flow in the unconsolidated zone.

Seven wells, including five monitor wells (R-1 through R-5) and two recovery wells (W-1 and W-10), were used to evaluate groundwater flow in the bedrock zone. These wells are cased to bedrock and then completed as open hole wells into bedrock.

Figure 2-8 is a groundwater contour map utilizing water levels measured 10 August 1988 in the seven bedrock wells listed above. The map indicates a deep cone of depression under the entire site. Bedrock groundwater flow at the site appears to be toward the recovery wells (W-1 and W-10) from all directions, with a relatively steep gradient. As noted previously, prior to 1988 the pumping rates at EKCO were lower, therefore the area of influence around W-1 and W-10 would have been less. Groundwater gradients are discussed in more detail in the following subsection.

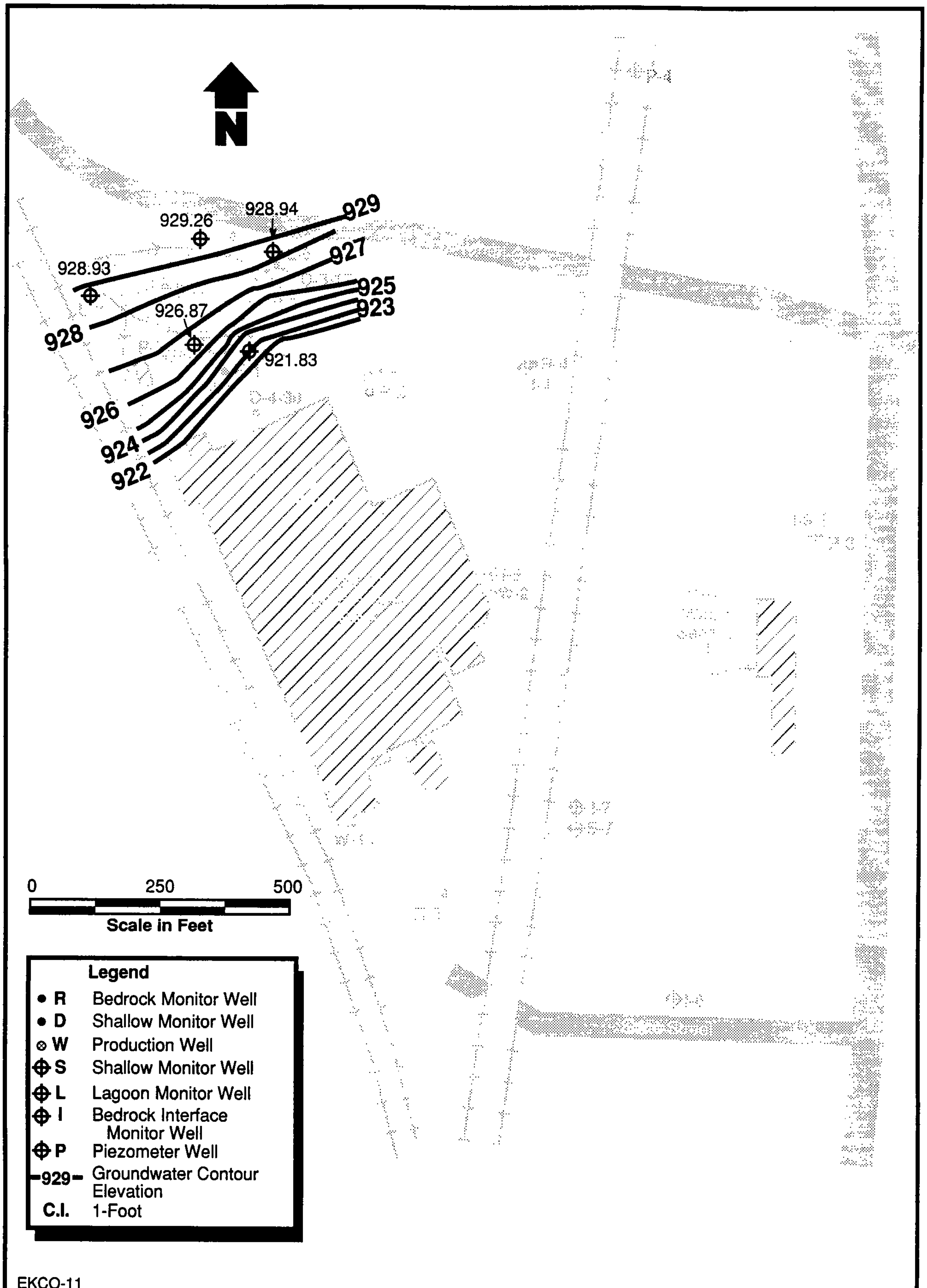

FIGURE 2-7 GROUNDWATER CONTOUR MAP FOR LAGOON WELLS, WATER LEVELS MEASURED 8-10-88

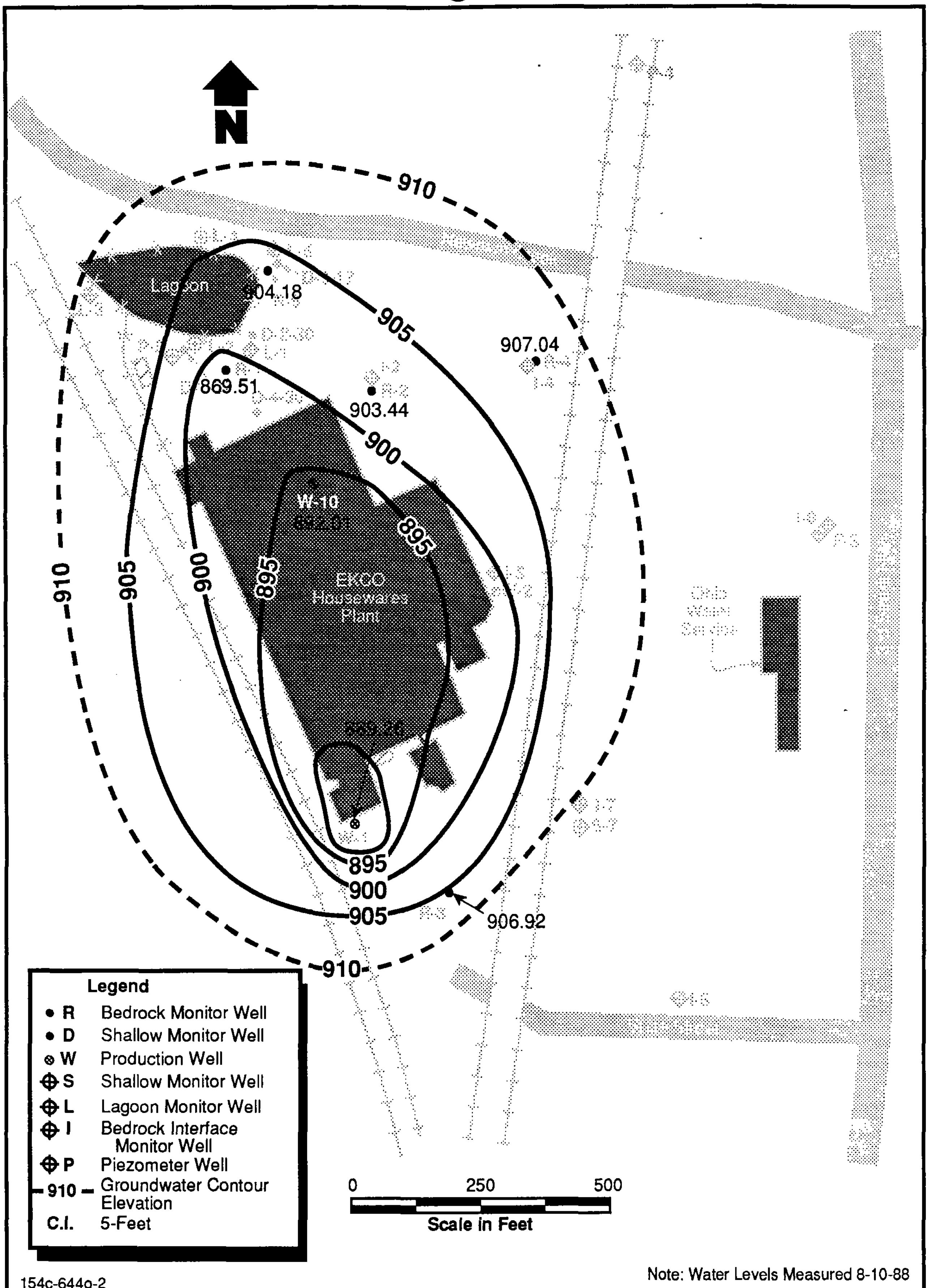

FIGURE 2-8 GROUNDWATER CONTOUR MAP FOR BEDROCK WELLS

2.2.2.3 Groundwater Gradients

Horizontal groundwater gradients were calculated for all three zones identified at the EKCO site. All gradients are affected by pumping and hence do not reflect native conditions. However, using the best available data, flow rates under actual conditions can be estimated. Horizontal gradients were calculated for each zone by measuring head loss between two wells and dividing by horizontal distance. The vertical gradient between the unconsolidated glacial material and the bedrock was calculated at two locations (R-2, I-2 and R-4, I-4). Vertical gradients were calculated by dividing the amount of head loss in two adjacent wells over the screen elevation difference in those same two wells. In both cases, a higher positive number indicates a steeper downward gradient. All water levels used in these calculations were measured 10 August 1988 during continuous pumping at EKCO recovery wells W-1 and W-10.

As can be seen from the contour map (Figure 2-6), the horizontal gradient in the fill materials varies across the lagoon area. The northern section has an average gradient of 0.030-feet/foot. The southern section has a steeper average gradient of 0.047-feet/foot. The steeper gradient to the south may be the result of the hydraulic influence of the pumping of well W-10.

The primary gradient in the unconsolidated zone is believed to be toward the north, with a local component toward the primary recovery well (W-10). The average horizontal gradient calculated for this zone was approximately 0.045 feet/foot. This gradient is roughly one-half as steep as that of the fill zone near the lagoon.

The bedrock horizontal groundwater gradient varied somewhat, perhaps due to varying transmissivities. The calculated average hydraulic gradient was 0.04 feet/foot.

The vertical gradient between the unconsolidated glacial material and the bedrock was calculated at two well pair locations (R-2, I-2 and R-4, I-4). This gradient was downward at both locations, due mainly to the pumping influence of wells W-1 and W-10. The vertical gradient from the screen in I-2 (unconsolidated layer) to the bedrock R-2 was 1.07 feet/foot. This indicates a steep downward gradient from the unconsolidated layer to the bedrock at this location. The vertical gradient calculated from I-4 to R-4 was 0.13 feet/foot, a smaller vertical gradient as compared to that between wells I-2 and R-2. This would be expected since R-4 and I-4 are farther away from the pumping influence of W-10 than are R-2 and I-2.

2.2.2.4 Interface Dewatered Zone

A boring for the proposed interface well, I-3, was drilled to bedrock next to R-3 south of the plant, and no water was encountered. All soil borings drilled along the western side of the plant were drilled to bedrock, and water was also not encountered in the unconsolidated zone at these locations. Where the water table intersects bedrock (estimated based upon nearby water elevations and bedrock depths) defines the eastern edge of the "dewatered zone". These data indicate that the unconsolidated material in this area has been dewatered due to present pumping conditions (Figure 2-7).

2.2.2.5 Estimated Rates of Groundwater Flow

Applying Darcy's Law ($V = KI/n$), a representative groundwater

- Silicon spray booth solids.
- Waste oil from hydraulic fluids and cutting oil.
- Scrap metal.
- Miscellaneous paper, plastic, and packing material.

The inactive SWMUs consist of the following:

- Incinerator.
- Old hazardous waste container storage area.

The locations of the SWMUs are shown in Figure 3-1.

From a corrective action approach, there are two operable units to be addressed: soils and groundwater. Soils remediation may include excavation and treatment/disposal or in situ treatment, while groundwater remediation will likely involve recovery and treatment.

The primary remedial response objectives of the RFI/CMS are to:

- Identify and investigate contaminant source areas.
- Delineate the extent and magnitude of soil and groundwater contamination.
- Evaluate potential environmental impacts from the identified contaminants.
- Develop and adequately evaluate sound corrective measures alternatives that will formulate a comprehensive remedial strategy to mitigate the hazardous constituents and their potential impacts on human health and the environment.

3.6 PREINVESTIGATION EVALUATION OF CORRECTIVE MEASURES TECHNOLOGIES

Potential corrective measures technologies applicable to the EKCO site can be divided into two categories: groundwater corrective measures and source corrective measures. These technologies are listed in Table 3-2. These technologies have been identified and evaluated here primarily to identify data

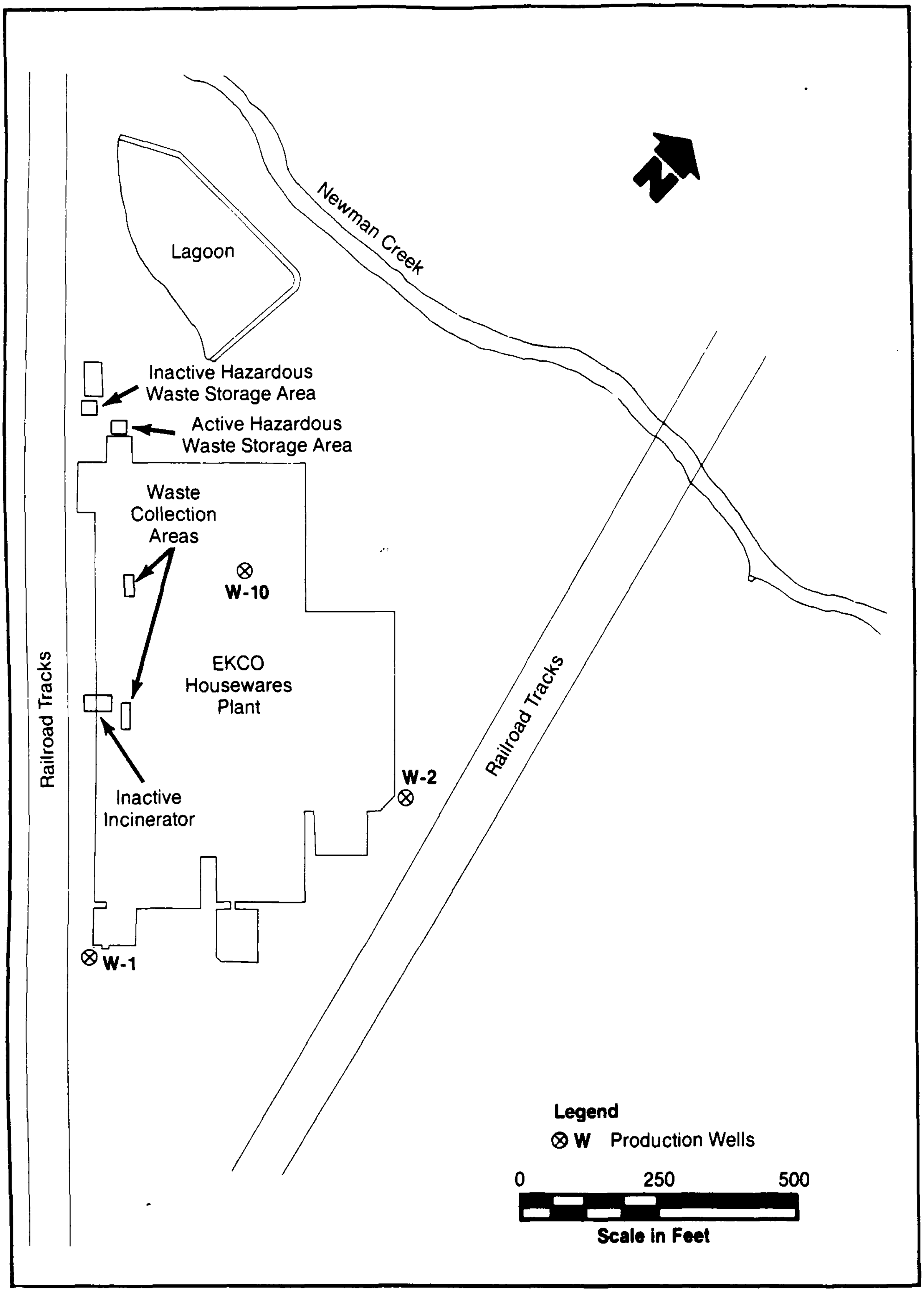

FIGURE 3-1 LOCATIONS OF SOLID WASTE MANAGEMENT UNITS AT EKCO HOUSEWARES, INC., MASSILLON, OHIO

WESTON

Table 3-2

Preinvestigation Evaluation of
Corrective Measures Technologies

Groundwater Corrective Measures Technologies

- Modifications to present recovery and treatment systems.
- Air stripping.
- Granular activated carbon (GAC).

Source Corrective Measures Technologies

- Raw materials and waste handling modifications.
- Operations modifications.
- In situ treatment technologies.
  - No action.
  - In situ volatilization (ISV).
  - Biological treatment.
  - Soil flushing.
- Excavation and treatment/disposal technologies.
  - Low temperature thermal treatment.
  - Onsite encapsulation.
  - Biological (landfarming and composting).
  - Soil washing.
  - Removal and offsite disposal.

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collection needs. Although these technologies will not be evaluated in detail until the CMS is undertaken, data must be collected during the RFI phase to permit a more detailed evaluation.

3.6.1 Groundwater Corrective Measures Technologies

3.6.1.1 Present Recovery and Treatment Systems

3.6.1.1.1 Recovery System

Two onsite production wells, W-1 and W-10, recover groundwater from the bedrock aquifer. Combined, the two wells withdraw over 400 gallons per minute (gpm), 24 hours per day. This pumping rate influences the groundwater flow in the bedrock zone by creating a cone of depression that extends beyond the property boundary.

3.6.1.1.2 Treatment System

The water withdrawn from these two wells is treated by an air stripping column to remove VOCs. The unit is a single-packed column 4 feet in diameter and 30 feet high, designed to treat 600 gpm of groundwater with a total VOC concentration not exceeding 40 ppm. A study of 1986 and 1987 levels indicated that the concentration of VOCs in the recovered groundwater has decreased during this period from 18 ppm to below 8 ppm.

3.6.1.2 Modifications to the Present Groundwater Recovery System

As discussed previously, groundwater is recovered through two recovery wells at the site open within the bedrock aquifer. Any modifications to this recovery system would involve changing either the number of wells or the well placement. Also, pumping rates could be increased to treat more groundwater and/or increase the zone of influence resulting from the pumping of each well. Possible scenarios might include the addition and/or abandonment of recovery wells. Other single recovery wells could be added at strategic locations onsite to capture contaminated groundwater. This could include installing recovery wells in the unconsolidated aquifer as well as the bedrock aquifer.

If it is necessary to install a series of adjacent recovery wells with overlapping zones of influence, a well point system may be preferable to single wells. The system of well points would consist of a series of shallow wells connected to a header pipe through which one suction pump would draw groundwater from each well. Well points can be less expensive than installing a series of adjacent single recovery wells, but they are limited in pumping capacity. Also, suction pumping is only effective to depths of 25 feet or less.

An alternative to well points for shallow recovery is a subsurface drainage system. Subsurface drains function as a continuous line of recovery wells to contain or to lower the groundwater table. Subsurface drains can be advantageous over well systems in two cases. First, when the subsurface materials have a relatively low hydraulic conductivity, wells have a limited radius of influence, requiring wells to be closely spaced. The installation of many closely spaced wells can be more costly than installing subsurface drains. Second, when recovery is considered necessary for a relatively long time, subsurface drains typically offer the advantage of lower operation and maintenance cost.

3.6.1.3 Modifications to the Present Groundwater Treatment System

The present groundwater treatment consists of a single air stripping column. Should the RFI/CMS determine that this treatment scenario is not adequate, the following modifications are possible:

- Modify the air stripper unit operation (e.g., air to water ratio) or add a second air stripping column to improve the overall removal efficiency.

- Add a liquid phase granular activated carbon (GAC) system following the air stripper to further reduce contaminant concentrations (and/or to remove contaminants not effectively removed by air stripping).

- Add a vapor-phase GAC system to treat the air emissions from the air stripper.

The air stripping and GAC technologies are described in Tables 3-3 and 3-4.

3.6.2 Source Corrective Measures Technologies

3.6.2.1 Raw Materials and Waste Handling Modifications

The raw materials and waste handling procedures that potentially need modification are identified through a review of QA/QC procedures used during operations of the SWMUs.

3.6.2.2 Operations Modifications

This activity includes a review of safeguards that ensure that operational failures (such as faulty piping cracks, structural failure in dike walls, lack of protection from dike wall erosion, or other occurrences) would not result in spills.

3.6.2.3 In Situ Treatment Technologies

The identified in situ technologies consist of no action (i.e., natural flushing), in situ volatilization (ISV), biological treatment, and soil flushing. These technologies are profiled (with data collection needs identified) in Tables 3-5A through 3-5D.

Table 3-3

Air Stripping

Applicability	VOCs are removed from an aqueous stream by transferring them to an air stream.
Constituents Addressed	VOCs in groundwater.
Advantages	Can be an effective and relatively inexpensive method for removing VOCs from water. Up to 99.9 percent removal of some VOCs is possible. Portable units are readily available and easily installed.
Limitations	Complete removal of compounds is usually not possible. Therefore, some treated streams may require further treatment or polishing. Gaseous emissions may require treatment prior to being released to the atmosphere. Permits may be required. Aqueous waste streams with high suspended solids concentrations or elevated levels of iron, manganese, or carbonate may require special operating conditions or procedures to prevent the unit from clogging.
Data Required	After characterizing the stream for standard organic and inorganic parameters, vendors can be contacted for estimated removal efficiencies.

Table 3-4

Granular Activated Carbon (GAC) Adsorption

Capabilities	Organic contaminants in aqueous or vapor streams are removed by adsorption onto the carbon. The depleted carbon is normally treated thermally to destroy the removed contaminants.
Constituents Addressed	Organic compounds in groundwater and vapor phase (e.g., from air stripper).
Advantages	A convenient and often very effective method for removing a variety of organic contaminants. Up to 99 percent removal efficiency is possible. Effective as either the primary or secondary (polishing) treatment step. Allows for the complete destruction of removed contaminants by thermal treatment. In large enough systems, the carbon can be recycled by thermal regeneration.
Limitations	Certain compounds are very poorly adsorbed. More efficient at removing compounds from vapor phase than from liquid phase.
Data Required	After characterizing the stream for standard organic and inorganic parameters, vendors can be contacted for estimated removal efficiencies and carbon usage rates.

Table 3-5A

No Action (i.e., Natural Flushing)

Applicability	Soils are neither treated nor encapsulated. Instead, natural stormwater infiltration is allowed to flush contaminants over time.
Constituents Addressed	Inorganic and organic compounds capable of being flushed or leached by stormwater.
Advantages	No excavation, treatment, or disposal required. Site is left undisturbed.
Limitations	Must show that potential contaminant migration will not present a threat to human health or the environment. Monitoring would be required. A groundwater remediation program may be required.
Data Required	A column leaching study, to identify contaminant migration potential, would be required. An endangerment assessment would also be necessary.

Table 3-5B

In Situ Volatilization (ISV)

Applicability	Removes VOCs from subsurface soils by mechanically drawing or venting air through the soil matrix.
Constituents Addressed	VOCs.
Advantages	Can be very effective at removing the great majority of VOCs in soils without excavating. Generally, compounds with higher vapor pressure and lower water solubility are more efficiently removed.
Limitations	Air emission controls may be required. The controlling mechanisms for vapor and chemical diffusion are site-specific and may not be easily evaluated. Key factors affecting the volatilization of VOCs from soil include soil moisture content, soil porosity and permeability, clay content, and chemical factors such as solubility, concentration, and volatility.
Data Required	Laboratory and pilot-scale treatability studies are necessary to determine feasibility and design criteria. Specific information required includes:

Parameter	Analysis
• Soil type	• Sieve analysis
• Soil porosity	• Natural moisture content, dry density, and specific gravity
• Soil moisture content	• Percent moisture

Table 3-5C

Biological Treatment (In Situ)

Applicability	Treats and destroys organic compounds in subsurface soils by adding oxygen and nutrients to enhance the natural biodegradation processes.
Constituents Addressed	Organic compounds.
Advantages	Can be an efficient and relatively inexpensive method for destroying organic contaminants without excavating soils.
Limitations	The technology is sensitive to many environmental factors that must be monitored and controlled during system operation. The most limiting factor is the permeability of site soils. In general, this technology has not been very successful at sites where contamination is at a significant depth or in clayey soils. The presence of heavy metals contamination may be toxic to microbes. Since the process is limited by the biological degradation rate, the time to achieve specific cleanup levels is unknown.
Data Required	Laboratory or pilot-scale treatability studies would be necessary to confirm the feasibility of biodegradation, as well as to determine design and operating parameters. Specific information required includes:

Parameter	Analysis
• Soil pH	• pH
• Soil moisture content	• Percent moisture
• Soil nutrient concentrations	• Organic carbon (TOC), nitrogen, and phosphorus

Table 3-5C

Biological Treatment (In Situ)
(continued)

Parameter	Analysis
• Gross organic components	• BOD_5
• Soil desorption rates	• (specific analyses)
• Soil permeability/porosity	• (specific analyses)
• Groundwater dissolved oxygen content	• Dissolved oxygen (field measurements)
• Water-holding capacity of soils	• (specific analyses)
• Microbial activity amenity to site conditions	• Treatability study

Table 3-5D

Soil Flushing (In Situ Leaching)

Applicability	Water or an aqueous solution is injected into contaminated soils to carry or flush contaminants away. The solution is pumped to the surface for treatment.
Constituents Addressed	Inorganic and organic compounds that can be solubilized.
Advantages	Most suitable for conditions where soil and groundwater are both contaminated. Compounds not amenable to other in situ treatment technologies can be removed from soils without exavation.
Limitations	The technology is not very effective in clay-type soils and not cost-effective if the depth to groundwater is significant. Subsurface hydrogeology must be thoroughly studied, since subsurface features strongly affect feasibility. An extraction and treatment system for the solution is required. Finally, regulatory acceptance may be difficult.
Data Required	Laboratory and pilot-scale treatability studies are necessary to confirm the feasibility, as well as to determine design and operating parameters. Specific information required includes:

Parameter	Analysis
• Soil type	• Sieve analysis, plasticity test, and proctor compaction test
• Soil permeability	• Triaxial permeability test
• Soil organic content	• TOC analysis
• Contaminant solubility data	• Standard reference books
• Contaminant partitioning coefficients	• Standard reference books/literature search

WESTON

3.6.2.4 Excavation and Treatment/Disposal Technologies

The technologies identified consist of low-temperature thermal treatment, onsite encapsulation, biological (landfarming and composting), soil washing, and removal and offsite disposal. These technologies are profiled (with data collection needs identified) in Tables 3-6A through 3-6E.

3.7 RFI/CMS OBJECTIVES AND DATA REQUIREMENTS

3.7.1 Objectives

Based on the findings of the groundwater quality assessment (May 1989), three objectives of the RFI can be identified:

- Obtain additional groundwater quality information offsite.
- Obtain additional hydrogeologic information between the site and Ohio Water Service wells 1, 2, and 3.
- Further characterize the potential sources of contaminants to groundwater.

Acquiring the information on the nature and extent of contaminants will allow for the evaluation of applicable corrective measures alternatives that will be protective of human health and the environment and cost-effective. This is the objective of the CMS.

3.7.2 Data Requirements

Data requirements for the RFI can be divided into four groups:

- Chemical analyses of groundwater quality.
- Hydrogeologic data (e.g., direction of groundwater).
- Chemical analyses of sources of contamination.

Table 3-6A

Low-Temperature Thermal Treatment

Applicability	Volatile organic contaminants are removed from soils by application of thermal energy and are either destroyed or recovered, leaving the soil suitable for onsite backfill.
Constituents Addressed	VOCs.
Advantages	Effective for nearly complete destruction of VOCs. Soils are treated onsite and are usable as onsite backfill.
Limitations	Trial burns and an air emission permit may be required for regulatory acceptance.
Data Required	A pilot-scale treatability study is required.

Table 3-6B

Onsite Encapsulation

Applicability	Contaminated soils are excavated, stabilized, and encapsulated (covered) onsite. The cover prevents the waste from migrating.
Constituents Addressed	Soils containing all types of contaminants.
Advantages	May be more cost-effective than treatment technologies; sometimes it is the only feasible option available. Prevents the transportation of wastes to an offsite landfill.
Limitations	An investigation is necessary to define potential pathways for contaminant migration. Since wastes are not destroyed, liability is not diminished, and long-term monitoring and maintenance are required.
Data Required	Soil characteristics, permeability, contamination migration pathways.

Table 3-6C

Biological Treatment (Land Farming and Composting)

Applicability	Treats and destroys organic compounds in soils by adding nutrients to excavated soils to enhance the natural biodegradation process.
Constituents Addressed	Organic compounds.
Advantages	Can be an effective and relatively inexpensive method for destroying organic compounds in excavated soils. This technology is less sensitive to environmental factors than in situ biological treatment.
Limitations	Since the process is dependent on the biological degradation rate, the time to achieve specific cleanup levels is unknown.
Data Required	Laboratory or pilot-scale treatability studies would be necessary to confirm the feasibility of biodegradation, as well as to determine the design and operating parameters. Specific information required includes:

Parameter	Analysis
• Soil pH	• pH
• Soil moisture content	• Percent moisture
• Soil nutrient concentrations	• Organic carbon, nitrogen, and phosphorous

Table 3-6C

Biological Treatment (Land Farming and Composting)
(continued)

Parameter	Analysis
• Soil desorption rates	• (specific analyses)
• Microbial amenity to site conditions	• Treatability study
• Depth to groundwater	• Remedial facility investigation (RFI)
• Gross organic components	• BOD_5

Table 3-6D

Soil Washing

Applicability	Contaminants are extracted ("washed") from excavated soils. The soils are fed into a contactor or washing unit, and contaminants are removed by the washing fluid. The washing fluid is treated to remove the contaminants and is then recycled. The soils are dried or dewatered and returned to the site.
Constituents Addressed	Organic and inorganic compounds, including heavy metals.
Advantages	The principle is the same as in soil flushing (in situ leaching), except that soil flushing is practiced in situ, whereas soil washing primarily requires soils to be excavated. Compared to soil flushing, soil washing has the following advantages: • Better process control can provide more effective contaminant removal, as disaggregation of soil particles improves soil water contact. • Use of additives or washing fluids such as solvents is simplified due to the elimination of the risk of uncontrolled groundwater contamination and environmental degradation. • Smaller volumes of washing fluid are required and fluid recycling improved.

Table 3-6D

Soil Washing
(continued)

Limitations	A separate leachate treatment system is required to recycle the washing solution. The contaminants removed by this treatment system, while in a concentrated form, will require further treatment, usually requiring treatment offsite. Variability of waste types can make formulation of suitable washing fluids difficult. Problems have arisen with the use of some washing fluids employing water/surfactant systems because a leachate treatment system has not yet been developed to selectively remove contaminants and pass the surfactants through intact.
Data Required	Laboratory and pilot-scale treatability studies are necessary to confirm the feasibility, as well as to determine design and operating parameters.

Reference: U.S. EPA, 1986. "Mobile Treatment Technologies for Superfund Wastes." EPA/540/2-86/003(F). Office of Emergency and Remedial Response, Washington, D.C. 20460.

Table 3-6E

Removal and Offsite Disposal

Applicability	Contaminated soils are excavated and transported to a permitted, approved, offsite facility for land disposal.
Constituents Addressed	All soil contaminants.
Advantages	Contaminated soils are removed, thus preventing future contaminant migration. May be less expensive than treatment technologies.
Limitations	Liability is increased by the transportation and offsite disposal of wastes. Land disposal ban restrictions may apply. Landfill capacity may be limited, resulting in excessive costs.
Data Required	Must determine if land disposal ban regulations apply based on the contaminants identified. May need to perform TCLP tests if wastes are considered land ban hazardous waste. Must identify a permitted disposal facility with available capacity that will accept the waste.

- Physical data on sources allowing for potential corrective measures.

These data requirements will be discussed in greater detail in Section 4 of this report.

3.8 APPROACH TO THE RFI/CMS

The proposed RFI/CMS at the EKCO facility is a pro-active step to address potential environmental concerns at the site. Since 1987, three environmental programs have been implemented at this site:

- Interim measures.
- Lagoon investigation of the regulated unit.
- Groundwater quality assessment.

Therefore, the RFI/CMS represents the next logical step in the investigation of the nature and extent of contaminants and the evaluation of necessary corrective measures to protect human health and the environment.

Based on the results of the groundwater quality assessment and the other above mentioned investigations, the scope of the RFI has been focused to address soils and groundwater (environmental media) and volatile organic compounds and heavy metals (constituents).

SECTION 4

RFI/CMS SCOPE OF WORK

4.1 RCRA FACILITY INVESTIGATION--TASK IV

The RCRA Facility Investigation will consist of the environmental data collection necessary to assess the nature and type of hazardous constituents that may be migrating from solid waste management units (SWMUs) onsite. The scope of work has been developed to supplement investigative efforts completed and reported in the "Groundwater Quality Assessment Report" (May 1988) by WESTON.

4.1.1 Groundwater Investigation

4.1.1.1 Straddle Packer Testing

In order to evaluate the vertical extent of VOC contamination of groundwater in the bedrock beneath the site, straddle packer tests will be performed on monitor wells R-1 and R-2. Inflatable straddle packers will be utilized to isolate and test zones of interest within the open borehole sections of the well bores. Discrete sampling and pumping will be performed to provide water quality and hydrologic data within the straddled zones.

Prior to performing the packer tests, borehole geophysical logging will be performed on monitor wells R-1, R-2, and R-4 to obtain information necessary for selection of packer intervals. Caliper, gamma, and flow meter logs will be run and appropriate smooth borehole sections (ideally), situated adjacent to shale beds, will be identified for seating packers to provide seals. Final packer intervals will be selected to provide as much control of the vertical distribution of VOCs as can safely be obtained; constraints upon the number of tests and upon packer spacing will be the condition of the borehole and the distribution and thickness of shale beds.

The specific protocol that will be followed in performing the packer tests is described in the RFI/CMS QAPP in Appendix C.

4.1.1.2 Monitor Well Installation

Thirteen additional groundwater monitor wells will be installed using cable tool drilling methods. Wells will be installed at 10 locations to characterize water quality and assess the hydrogeologic conditions between the EKCO site and OWS wells 1, 2, and 3. The use of cable tool drilling will allow collection of continuous lithologic samples.

4.1.1.3 Location Rationale

The approximate locations of monitor wells to be installed are presented in Figure 4-1. All of the proposed monitor well locations, with the exception of S-4 and R-7, are off of EKCO property. Therefore, access for installation of these monitor wells must be obtained prior to the commencement of field activities. In the event the access is denied to EKCO, a request for EPA or OEPA to obtain access will be submitted. If EPA or OEPA cannot obtain access, then alternate monitor well locations will be proposed. Table 4-1 presents, in summary form, the rationale and/or intended purpose for each of the proposed monitor wells. Decisions regarding any additional bedrock monitor wells will be based upon the results of the straddle packer testing (see Subsection 4.1.1.1).

4.1.1.4 Monitor Well Construction

The shallow ("S") and unconsolidated overburden interface wells ("I") will be constructed using 4-inch I.D. wound-wire type 304

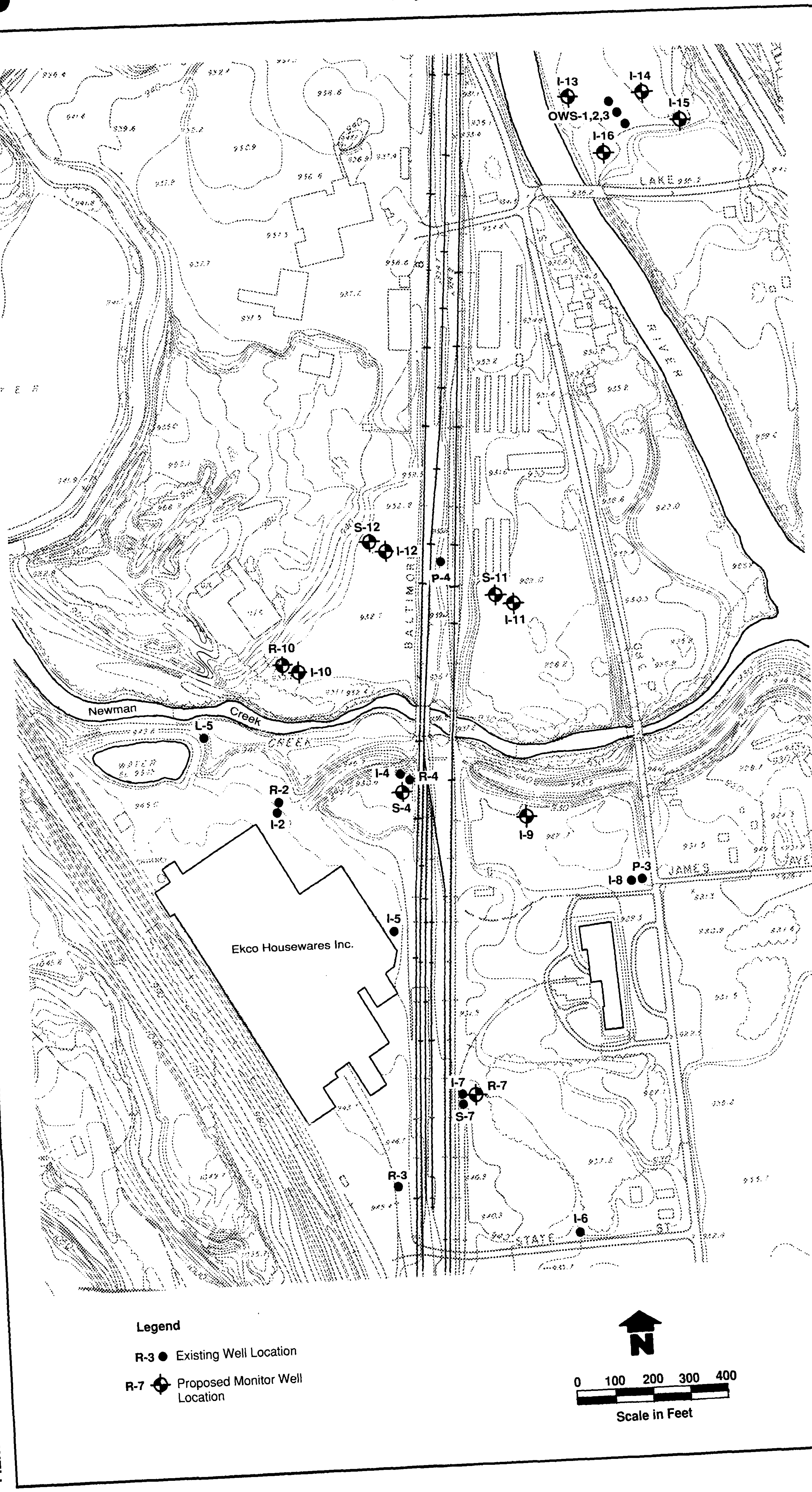

FIGURE 4-1 PROPOSED MONITOR WELL LOCATIONS

Table 4-1

Groundwater Monitor Wells Location Rationale

Monitoring Well	Location	Rationale/Purpose
S-4	Located near wells I-4 and R-4.	Evalute shallow groundwater quality near NE facility boundary.
R-7	Located near well I-7.	Evaluate groundwater quality in bedrock below I-7, which shows VOCs.
I-9	Located between I-4 and I-8.	Provide hydraulic control.
I-10/R-10	Located north of Newman Creek.	Groundwater quality across Newman Creek.
I-11, S-11, I-12, and S-12	Located between the site and OWS wells 1, 2, and 3.	Assess hydraulic gradient and groundwater quality in the unconsolidated aquifer between the site and OWS wells 1, 2, and 3.
I-13, I-14, I-15, and I-16	Located in the vicinity of OWS wells 1, 2, and 3.	Establish better hydraulic control in the area.

Note: Wells identified by an "I" will be screened near the bedrock/unconsolidated material interface, except I-13 through I-16, near the OWS wells. These wells will be installed with screens within the screen elevation intervals of OWS-1, -2, and -3. Wells identified by an "S" will be screened near the water table.

stainless steel screens, stainless steel risers, and a protective black iron surface casing with lockable cap. Shallow monitor wells S-4, S-11, and S-12 will have 10-foot screens installed into the first encountered water-bearing zone (in the unconsolidated sediments). A generalized well construction diagram for these shallow wells is presented in Figure 4-2. Similar construction of the interface wells, I-9 through I-12, will be used, except that the 10-foot screens will be installed to the bedrock/unconsolidated material interface. Wells I-13 through I-16 will be installed with screens within the screen elevation intervals of the OWS wells nearby. Wells R-7 and R-10 will be installed with screens within the first saturated sandstones (of substantial thickness) encountered.

At the determined depth in the shallow wells, the well screen and riser will be installed and the drive casing augers withdrawn to the top of the screen. Silica sand will be used to backfill the annular space after the drive casing is withdrawn. When plumbing the hole indicates that the sand pack is at the desired height, a 2-foot bentonite pellet seal will be placed on the top of the sand pack as the augers are gradually withdrawn. The shallow wells will be completed by gravity-feeding a neat cement mixture into the remaining annular space. After completion, the grout will be checked for settlement and more neat cement will be added as necessary. The upper 2.5 feet of annular space will be filled with a cement/sand mixture and a protective casing will be installed. All well construction materials and tools will be decontaminated in accordance with the procedures described in the RFI/CMS QAPP in Appendix C, or will be used directly from factory-sealed packages or containers.

Similar well installation techniques are proposed for bedrock/ overburden interface wells, the wells near OWS 1, 2, and 3, and

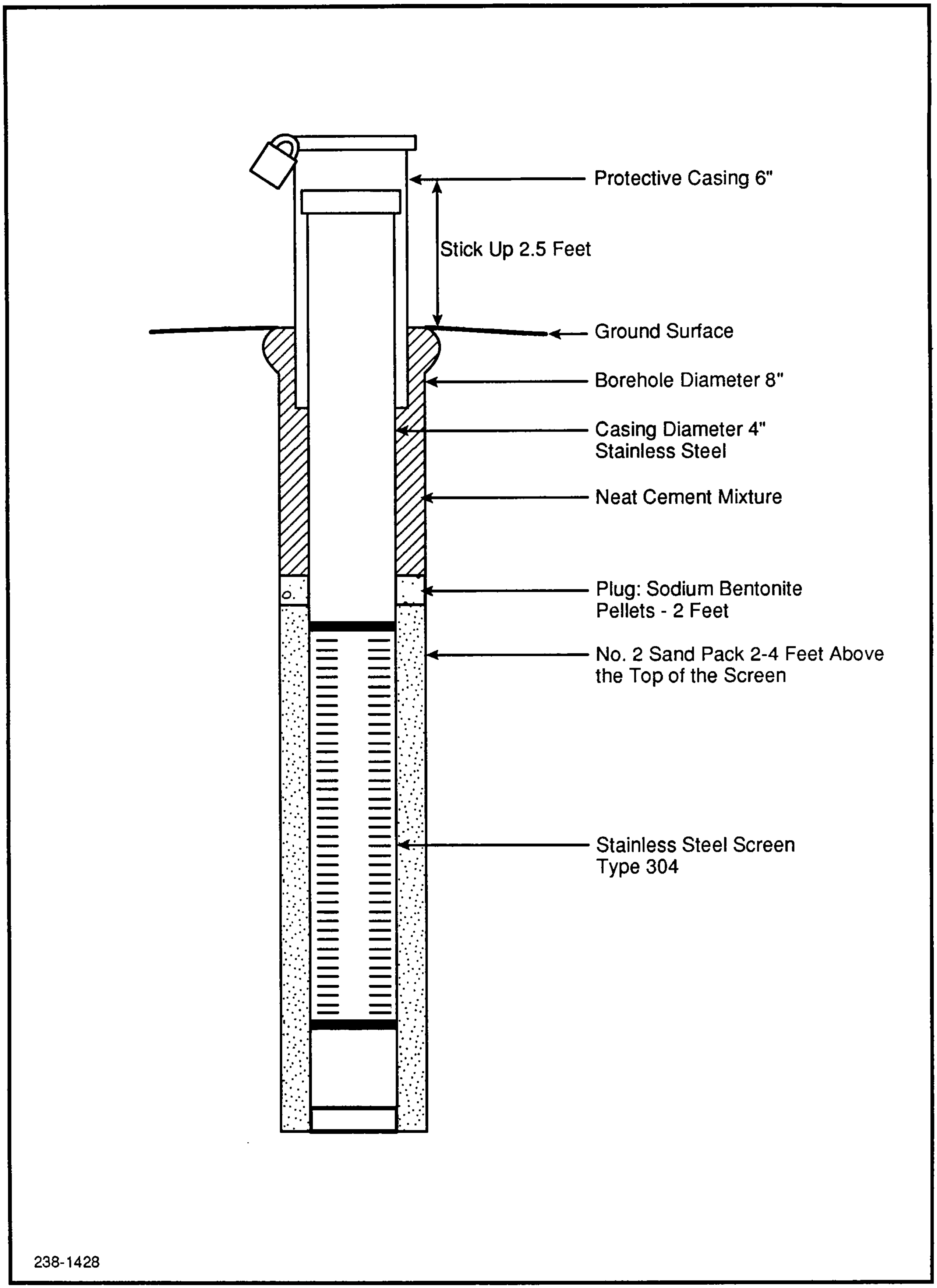

FIGURE 4-2 TYPICAL SPECIFICATIONS FOR MONITOR WELL COMPLETION

the bedrock wells. A natural sand pack will extend approximately 2 feet above the screen, and a bentonite slurry will be pumped through the tremie from the top of the sand pack as the drive casing is gradually withdrawn so that no collapse of the borehole occurs. These wells will be completed by treming a neat cement mixture to the bottom of the hole to displace the water in the annular space. As the drive casing is slowly withdrawn, the level of the grout will be maintained inside the drive casing by pumping additional grout to the bottom of the hole. A protective black iron casing will then be installed.

Each new well will be developed approximately 1 day after installation with a pump or bailer until a steady flow of clear water is obtained and until at least five well volumes are removed. The pump intake will be moved through the length of the screen or open borehole during development. If a sufficient head cannot be maintained during pumping, a bailer and surge block method will be employed. All onsite purge water will be collected in a tanker provided by EKCO and will be taken to the onsite air stripper for processing and discharge.

All well development equipment will be decontaminated prior to use in each well in accordance with procedures described in the RFI/CMS QAPP in Appendix C.

4.1.1.5 Groundwater Sampling

Newly installed monitor wells I-9 through I-16, S-4, S-11 and S-12, and R-7 and R-10 will be sampled as specified in the RFI/CMS QAPP in Appendix C. The groundwater samples will be analyzed for VOCs and metals. Additionally, existing monitor wells, except those sampled quarterly under the RCRA program, will be sampled and analyzed semi-annually during the RFI for VOCs only, since heavy metals in the previous groundwater quality analyses have not indicated elevated metals concentrations in the groundwater. Depth to water measurements will be collected from all wells on a quarterly basis.

4.1.1.6 Aquifer Testing

A series of 8-hour, constant rate pumping tests will be performed on wells screened in the glacial outwash to obtain comparative, characteristic aquifer parameters across nearby portions of the valley. Wells to be tested include S-7, S-11, I-2, I-11, and I-16.

Data from well installation and development, together with short prepumping tests, will be used to determine optional pumping rates for each well. Actual aquifer tests will begin with the monitoring of static water levels, followed by approximately 8 hours of constant rate pumping, followed by monitoring of recovery until wells have recovered to at least 90 percent of their static (prepumping) levels.

The specific protocol for the aquifer tests is presented in Appendix C.

4.1.2 Source Characterization

The further characterization of potential sources of hazardous constituents to the groundwater is necessary. The groundwater quality assessment has identified four onsite areas that may continue to be sources of contaminants to the groundwater: the active tank area on the south end of the plant; the abandoned tank area on the north end of the plant near D-4-30; the sump at production well W-10 inside the plant; and the lagoon. Since the lagoon is being addressed as a regulated unit, it will not be considered during the RFI. Additional soil borings will be placed in the other areas to better characterize the areas and to provide information that may be necessary for corrective action.

4.1.2.1 Subsurface Soil Sampling

To further define the three areas described above, three to four additional soil borings will be placed in each of these areas. The proposed locations of the additional borings are shown in Figure 4-3. Soil samples will be collected continuously at each boring location and will be logged by the onsite geologist. Up to three samples will be retained from each boring for chemical analysis. Samples for analysis will be collected from depths of 2 to 4 feet, 6 to 8 feet, and 10 to 12 feet below ground surface. The sampling intervals may be modified at the discretion of the onsite geologist, based upon organic vapor detection, discoloration, odors, or recovery. Samples will be analyzed for VOCs. The soil boring protocol is specified in the RFI/CMS QAPP in Appendix C.

4.1.3 Refinement of Groundwater Flow Model and Transport Modeling Effort

4.1.3.1 Refinement of Groundwater Flow Model

The existing site groundwater flow model (MODFLOW) will be refined based upon additional hydraulic information obtained from the new monitor wells. Data input will include static and pumping water level elevations, transmissivities, storage coefficients, lithology, thickness of the permeable bedrock zone, and other similar information. Data from new wells, including groundwater flow directions and estimated aquifer parameters based upon pumping tests, will be fully incorporated in the model calibration. The model will be recalibrated to allow simulation of onsite and offsite flow conditions so that an optimal groundwater control and recovery system can be designed and constructed. Data from the model setup and calibration, as well as findings, will be included in the RFI report.

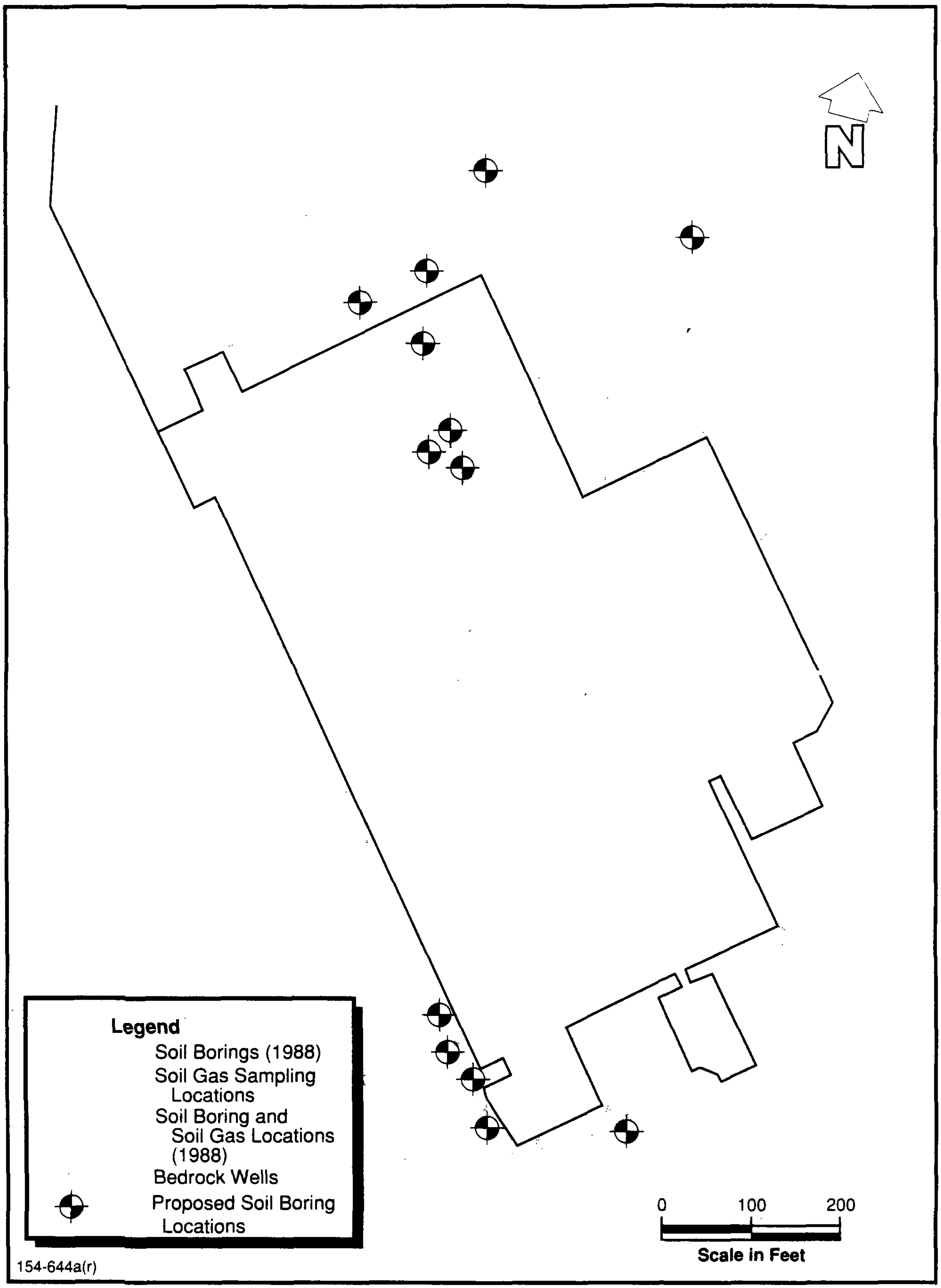

FIGURE 4-3 PROPOSED RFI SOIL BORING LOCATIONS

4.1.3.2 Contaminant Transport Modeling

A final phase of the modeling effort may include the application of a solute transport model, such as the U.S. Geological Survey's Method of Character (MOC) Model or other analytical model, to provide a more comprehensive database to support the selection of an appropriate groundwater recovery scenario. The solute transport model selected will be calibrated against existing groundwater quality information and will incorporate the effects of variable source strengths. If appropriate, selection of a transport model will be made following the refinement of the existing flow model so that the best-fit transport model can be selected.

4.2 INVESTIGATION DATA ANALYSIS--TASK V

Two types of data will be collected during the RFI: field observations and/or direct measurements, and measurements that will be performed in the laboratory (i.e., chemical and physical analyses of groundwater and subsurface soils). The data will be reviewed to ensure that the data are of sufficient quality and quantity to describe the nature and extent of contamination.

In addition, the data will be evaluated to assess the potential threat to human health and the environment. This will be performed by comparing the data to appropriate standards, including the groundwater protection standards as specified in 40 CFR 264.94, safe drinking water standards, ambient water quality standards, ambient air quality standards, and corresponding State of Ohio standards.

4.3 RCRA FACILITY INVESTIGATION REPORT--TASK VI

The RCRA Facility Investigation (RFI) report will be prepared in draft form and submitted to EPA for review. The RFI report will present the following information:

- Site description.
- Environmental setting.
- Summary of field investigation.
- Results of the investigation.
- Results of the evaluation of data.
- Results of groundwater modeling efforts.
- Conclusions.

4.4 IDENTIFICATION AND DEVELOPMENT OF THE CORRECTIVE MEASURE ALTERNATIVE(S)--TASK VII

Based upon the results of the RFI and consideration of the identified preliminary corrective measures technologies (CMTs) (Task II), alternatives for the removal, containment, treatment, and/or other remediation of the contaminants at the site will be identified, screened, and developed based on the objectives established for the corrective action.

4.4.1 Description of Current Situation

The RFI report will be updated, if applicable, to describe the current situation at the facility, including the nature and extent of contamination. Also, an update will be provided regarding previous response activities and any interim measures that have been or are being implemented at the facility. Accompanying the description of any such response activities will be a facility-specific statement of the purpose for the response based on the results of the RFI. The statement of purpose will identify the actual or potential exposure pathways to be addressed by the corrective measures.

4.4.2 Establishment of Corrective Action Objectives

Site-specific objectives for the corrective action will be established to address the protection of human health and the environment. These objectives will be based on public health and environmental criteria, information gathered during the RFI, applicable EPA guidelines, and applicable requirements of

Federal and state statutes. All corrective actions concerning groundwater releases will be consistent with, and as stringent as, those required under 40 CFR 264.101.

4.4.3 <u>Screening of Corrective Measure(s) Technologies</u>

The technologies specified in Section 3 of this Work Plan will be reassessed at the completion of the RFI to identify any additional applicable technologies. The technologies identified in Task II and any supplemental technologies identified under this subtask will be screened to eliminate those that may not be feasible to implement, that rely on technologies unlikely to perform satisfactorily or reliably, or those that do not achieve the corrective measure objective within a time period that is environmentally protective and cost-effective. The screening process will focus on eliminating technologies that have limitations for the given set of waste- and site-specific conditions. The screening process will also eliminate technologies based on commercial availability and inherent technology limitations.

Site, waste, and technology characteristics that will be used to screen inapplicable technologies are described in more detail below:

- Site Characteristics--Site data will be reviewed to identify conditions that may limit or promote the use of certain technologies. Technologies whose use is clearly precluded by site characteristics will be eliminated from further consideration.

- Waste Characteristics--Identification of waste characteristics that limit the effectiveness or feasibility of technologies is an important part of the screening process. Technologies clearly limited by these waste characteristics will be eliminated from consideration. Waste characteristics particularly effect the feasibility of in situ methods, direct treatment methods, and land disposal (onsite and offsite).

- Technology Limitations--During the screening process, the level of technology development, commercial availability, performance record, and inherent construction, operation, and maintenance problems will be identified for each technology considered. Technologies that are unreliable, perform poorly, or are not fully demonstrated may be eliminated in the screening process.

4.4.4 Identification of the Corrective Measure Alternative(s)

After screening potential technologies, compatible technologies will be assembled to form comprehensive remedial alternatives. These will include a no action alternative. The alternatives developed will represent workable options that appear to adequately address all site problems and corrective action objectives. These alternatives will be subject to detailed evaluation as discussed in Subsection 4.6. Remedies that use permanent solutions and alternative treatment and/or resource recovery technologies will be given preferential consideration.

4.5 LABORATORY AND BENCH-SCALE STUDIES, IF NECESSARY--TASK VIII

In order to properly evaluate the technical feasibility and effectiveness of retained remedial alternatives, it may be necessary to conduct laboratory and bench-scale treatability studies on those component technologies where the ability to treat depends on site-specific contaminants and media, or where sufficient treatability and full-scale implementation data are not available (e.g., innovative technologies). The decision to proceed with any studies will be made after discussions with EPA and OEPA representatives.

If determined appropriate, any studies would be preceded by the development of a test/study plan for each technology. Each plan would describe the goal of the study, the level of effort needed, specific testing procedures, analyses to be performed, and the procedures for data management and interpretation.

Upon completion of such a study, a report would be prepared to summarize and evaluate the program results. The report would include procedures, analyses, results, conclusions, and recommendations from the study as performed.

4.6 EVALUATION OF THE CORRECTIVE MEASURE ALTERNATIVE(S)--TASK IX

Each corrective measure alternative that passes through the initial screening process will be evaluated based on technical, environmental, human health, and institutional criteria. A cost estimate will also be developed for each alternative considered to be technically feasible and environmentally effective.

4.6.1 Technical, Environmental, Human Health, and Institutional Evaluations

Each corrective measure alternative will be evaluated based on the following four criteria:

1. Technical--The technical evaluation criteria include performance, reliability, implementability, and safety.

    a. Performance will be evaluated based on the effectiveness and useful life of the corrective measure technology as follows:

        i. Effectiveness will be evaluated in terms of the ability to perform intended functions such as containment, diversion, removal, destruction, or treatment. The effectiveness of each corrective measure shall be determined either through design specifications or by performance evaluation. Any specific waste or site characteristic that could potentially impede effectiveness shall be considered. The evaluation will also consider the effectiveness of combinations of technologies.

        ii. Useful life is defined as the length of time the level of effectiveness can be maintained. Corrective measures technologies, with the exception of destruction technologies, may potentially show deteriorating performance with time. Often, deterioration can be slowed through proper system operation and maintenance, but the technology eventually may require replacement. Each corrective measure alternative will be evaluated in terms of the projected service lives of its component technologies, as well as appropriateness of the technologies.

b. The reliability of each alternative will be evaluated in terms of its ability to meet corrective action objectives and/or performance standards, including its operation and maintenance requirements and their demonstrated effectiveness.

c. The implementability of each alternative will be evaluated in terms of relative base of installation (constructability), availability, and the time required to achieve the corrective action objectives.

d. The safety of each alternative will be evaluated in terms of risks posed to workers and/or the community during startup and operations.

2. Environmental--An Environmental Assessment (EA) of each alternative will focus on the facility conditions and pathways of contaminant migration actually addressed by the alternative. The EA for each alternative will include an evaluation of the short- and long-term beneficial and adverse effects on environmentally sensitive areas and an analysis of measures to mitigate adverse effects.

3. Human Health--Each alternative will be assessed in terms of the extent to which it mitigates short- and long-term potential exposure to any residual contamination and how it protects human health both during and after implementation of the corrective measure. The assessment will consider the levels and characterizations of contaminants onsite, potential exposure routes, and the potentially affected population. Each alternative will be evaluated to determine the level of exposure to contaminants and the reduction over time. For management of mitigation measures, the relative reduction of impact will be determined by comparing residual levels of each alternative with existing criteria and standards.

4. Institutional--Relevant institutional needs or limitations for each alternative will be assessed. Specifically, the effects of Federal, state, and local environmental and public health statutes, standards, regulations, final guidance, or ordinances will be considered.

4.6.2 Cost Estimates

The approximate cost of construction, operation, and maintenance for the alternatives will be estimated. The objective in calculating these costs is to achieve an accuracy within -50 to +100 percent. Detailed cost estimating is not necessary because cost is used only as a secondary screening tool in this stage. Once alternatives have been evaluated as described in Subsection 4.6.1, the relative costs will be considered only to further screen those candidate alternatives that use similar approaches and achieve similar results. These costs will be obtained from existing literature containing costs for general applications and basic data for the given remedial alternatives. The total cost will include the cost of implementing (planning, permitting, design, and construction) the alternative and the subsequent cost of operation and maintenance.

4.7 RECOMMENDATION OF THE CORRECTIVE MEASURE OR MEASURES--TASK X

A corrective measure alternative will be recommended and justified using three of the four criteria listed in Subsection 4.6.1 (technical, environmental, and human health with institutional criteria not being considered). Summary tables will be included in the report to show the selection process of the recommended alternative.

4.8 CMS REPORTS--TASK XI

Progress reports and a Corrective Measures Study Report will be prepared and submitted to EPA and OEPA, as described in the following subsections.

4.8.1 Progress Reports

Signed progress reports will be prepared and submitted monthly.

The reports will contain the following items, as necessary:

- A description and estimate of the percentage of the CMS completed.
- Summaries of all findings.
- Summaries of all changes made in the CMS during the reporting period.
- Summaries of all contacts with the public regarding the CMS.
- Actions being taken to rectify problems.
- Changes in personnel during the reporting period.
- Projected work for the next reporting period.

4.8.2 Draft Report

The draft report will include:

- A description of the facility, including a site topographic map and preliminary layouts.
- A summary of the RFI and impact on the selected corrective measure(s).
- Description of the process and results of the following:
    - A summary of the corrective measure(s):
        - Description of the corrective measure(s) and rationale for selection.
        - Performance expectations.
        - Preliminary design criteria and rationale.
        - General operation and maintenance requirements.
        - Long-term monitoring requirements.
    - Identification and development of the corrective measures alternatives.
    - Evaluation of corrective measures alternatives.

- Design and implementation precautions:
  - -- Technical problems.
  - -- Additional engineering data required.
  - -- Permits and regulatory requirements.
  - -- Access, easements, right-of-way.
  - -- Health and safety requirements.
  - -- Community relations activities.

- A summary of laboratory or bench-scale studies (if performed).

- Selection of recommended corrective measures alternative, including the following:

  - Justification of selection.

  - Beneficial aspects of selected corrective measures alternative.

  - Limitations of selected corrective measures alternative.

4.8.3 Final Report

The Corrective Measures Study Report will be finalized, incorporating comments received from EPA and OEPA on the draft report, as required by the Consent Order.

SECTION 5

QUALITY ASSURANCE/QUALITY CONTROL

The specific QA/QC objectives for this project, along with the RFI/CMS Work Plan Quality Assurance Project Plan (QAPP) are summarized in Appendix C.

Contained in the QAPP is a Project Management Plan that includes a discussion of the technical approach and personnel. The schedule is contained in Section 7 of the Work Plan. The Project Management Plan also includes a description of the qualifications of personnel performing or directing the RFI, including contract personnel. This plan also documents the overall management approach to the RCRA Facility Investigation.

The QAPP also contains a plan to document monitoring procedures, sampling, field measurements, and sample analysis performed during the investigation to characterize the environmental setting, source, and contamination, if any, to ensure that all information, data, and resulting decisions are technically sound, statistically valid, and properly documented.

The data collection quality assurance is consistent with guidance issued under RCRA and other appropriate regulations and includes a description of:

- Quality assurance/quality control.
  - Field investigation procedures.
  - Field activities.
- Sample identification, documentation, and custody.
- Calibration procedures.
- Analytical program.
- Laboratory QA/QC checks.

- Performance and system audits.
- Preventative maintenance.
- Frequency of interval quality control checks.
- Corrective action.

In addition, the QAPP contains a Data Management Plan in accordance with applicable EPA Guidance Documents to document and track investigation data and results. This plan identifies and sets up data documentation materials and procedures, project file requirements, and project-related progress reporting procedures and documents. The plan also provides the format to be used to present the raw data and conclusions of the investigation.

SECTION 6

SITE HEALTH AND SAFETY PLANS

A Health and Safety Plan will be prepared for the site to ensure the heath and safety of all site personnel during the activities covered by the Work Plan.

The Health and Safety Plan (HASP) is to define specific procedures and protocols that will be implemented to protect the health and safety of all personnel during the completion of closure activities at the EKCO Housewares site. The plan will identify potential health and safety hazards at the site during the specific site activities and prescribe procedures to minimize effects of the hazards on personnel performing onsite activities. A copy of the HASP will be available at the site. The plan will address chemical and physical hazards.

All subcontractors will be required, at a minimum, to comply with the HASP. In addition, the subcontractors will be required to comply with all pertinent Federal, state, and local health and safety standards.

The following information must be supplied to WESTON by each subcontractor:

- A general statement indicating that the subcontractor's Health and Safety Program(s) is in compliance with applicable sections of 29 CFR 1910 and 1926. Specifically, the statement must identify that the subcontractor's employees are aware of, and that the subcontractor is in compliance with, the new OSHA standard 1910.120, "Hazardous Waste Operations and Emergency Response."
- A statement indicating that all employees who will or may take part in site operations during the closure activities are enrolled in and current with a medical monitoring program that complies with OSHA.

* A statement indicating that the subcontractor will provide protective equipment for its own employees, and that the equipment is NIOSH/OSHA-approved.

* A statement indicating that the subcontractor and its employees will follow the Health and Safety Plan and cooperate with the Site Health and Safety Coordinator.

* A listing of each employee who will be, or may be, involved with the project. This list should include the following information for each employee:

  - Name.

  - Start date.

  - Medical date (certifying fit to wear respiratory protection and to work at a hazardous waste site).

  - Training dates (specify type, quantity)

  - Experience in levels of protection (hours, weeks).

  - Years working in the field (experience).

SECTION 7

SCHEDULING

The schedule for the completion of activities has been forecasted to extend over 23 months, starting with the preparation of the Work Plan and ending with the submission of the final RFI/CMS report.

Figure 7-1 depicts the schedule and identifies the anticipated start and finish dates for each activity.

With the known work load conditions experienced at the WESTON Laboratories, WESTON anticipates turnaround of analysis and validation of analytical data to be approximately 10 weeks.

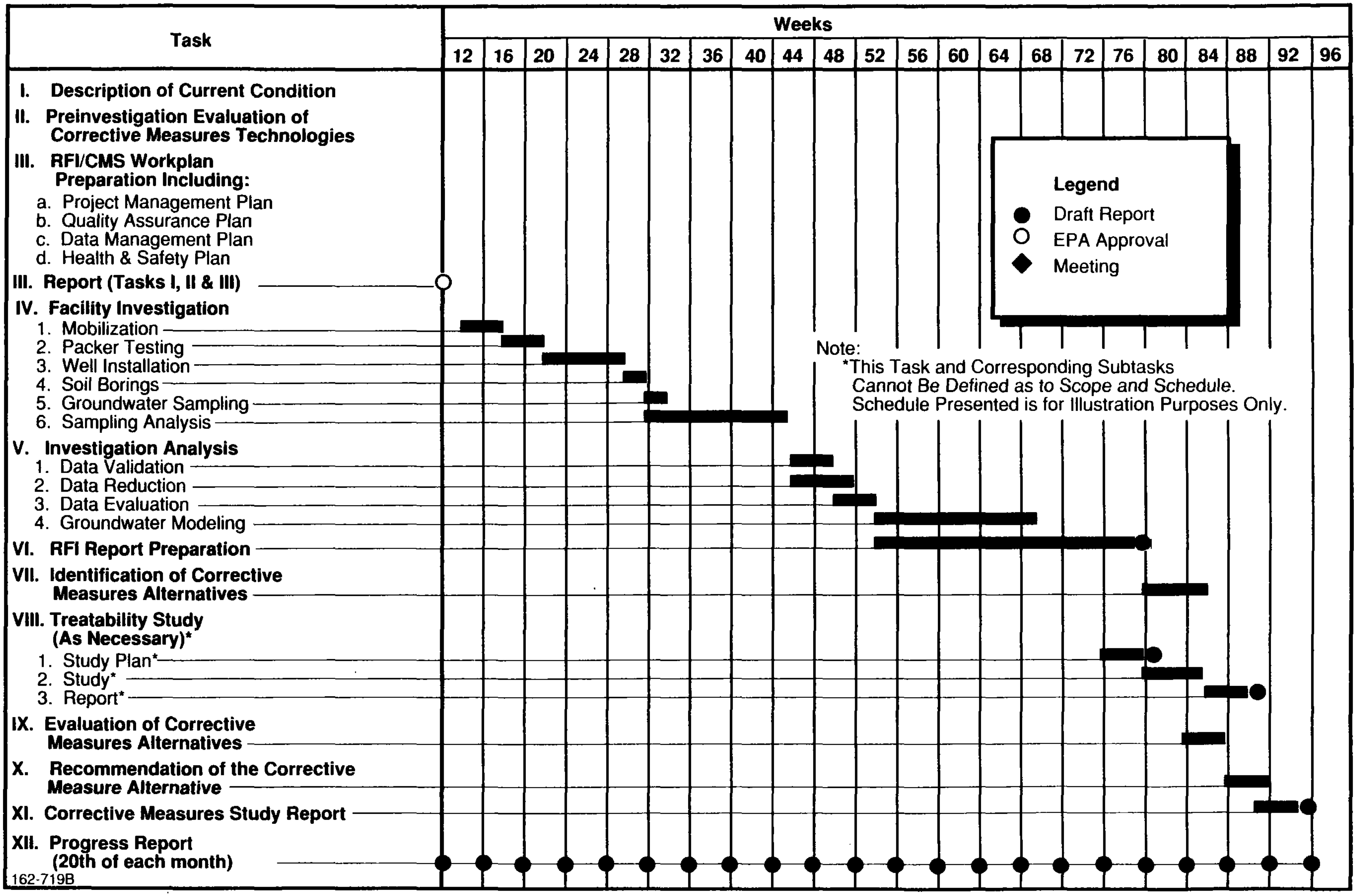

FIGURE 7-1 SCHEDULE FOR THE RFI/CMS AT EKCO HOUSEWARES, INC., MASSILLON, OHIO

SECTION 8

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APPENDIX A

SUMMARY OF PREVIOUS INVESTIGATIONS AND EFFLUENT QUALITY RANGES AT EKCO HOUSEWARES, INC., MASSILLON, OHIO

Table A-1

Summary of Previous Investigations at EKCO Housewares, Inc., Massillon, Ohio

Date	Performed by Whom	Scope of Investigation	Results of Investigation
1952-1987	EKCO	Ohio Department of Health discharge permit and NPDES permit.	Analyzed for pH, flow, copper, nickel, iron, oil and grease, and solids (see Table A-2, A and B).
March/ April/May 1984	EKCO/ Wadsworth Labs	Routine testing for renewal of NPDES permit.	Revealed up to 23 ppm total VOCs in lagoon soils, 5 ppm VOCs in incoming well water, and 4 ppm VOCs in plant effluent, 0.5 ppm in down-stream Newman Creek sample.
May 31, 1984	EKCO/ Wadsworth Labs	Testing soil in north and west tank farms.	Analysis showed up to 225 ppm total VOCs.
June 1984	EKCO/ Wadsworth	Testing NPDES sewer system for point sources of VOC contamination.	Total VOC analysis on samples from degreasing unit drainage pipes showed up to 6.3 ppm VOCs, degreaser refrigeration coils up to 1,400 ppm VOCs, manhole up to 11 ppm VOCs.
August 1984	EKCO/ Wadsworth	Further source area testing in plant.	Total VOC analysis on W-2 showed 3.4 ppm VOCs, and on carbon absorption steam lines showed 0.7 ppm VOCs.
Sept. 1984	Ohio Drilling Company	Four test holes were drilled to study shallow soils down to 20 feet. Two holes were made into piezometers, other two were plugged.	VOC analysis showed up to 250 ppm total VOCs in soils at 0-4 feet depth and up to 26 ppm total VOCs at 15 to 20-foot depths.
		3 bedrock test wells were completed and sampled, R1 through R3, also W-10 and W-2.	VOC analysis showed contamination at each well, with W-10 showing up to 143 ppm VOCs.

Table A-1

Summary of Previous Investigations at EKCO Housewares, Inc., Massillon, Ohio (continued)

Date	Performed by Whom	Scope of Investigation	Results of Investigation
Dec. 1984	Ohio Drilling Company	Resampling of W-10.	Total VOC analysis showed 104 ppm VOCs.
June 1985	Ohio Drilling Company	Additional R-well (R-4) drilled to better define contamination plume to northeast of EKCO facility.	Total VOC analysis detected no VOCs.
July 1985	EKCO/ Wadsworth	Five 3-foot soil cores taken from lagoon.	Soils tested for total VOCs and metals (both total and EP toxicity analysis). Results showed up to 71 ppm VOCs in soils with two samples exhibiting EP toxicity characteristics. All five exceeded ROFS limits.
March 1986 to January 1988	EKCO	Groundwater reclamation project started. Production wells pump groundwater through aquifer for air-stripping, then to plant use and/or discharge.	Total VOC analysis from groundwater reclamation reports are summarized in Figure A-1.
July 1986	EKCO/ Wadsworth	Six discrete samples taken from NPDES sewer system.	VOC analysis showed contamination in each sample up to 0.45 ppm VOCs. Plant outfall analysis showed 0.1 ppm VOCs.
July 9 to 10, 1986	Floyd Brown Associates, Ltd. (FBA)	12 test borings - Purpose to obtain soil samples and determine geological characteristics	Lagoon and downgradient sample composited by depth and analyzed for total metals and VOCs.
		4 in lagoon to 12 feet 4 downgradient to 12 feet 4 backgrounds to 3 feet	Background only for total metals. Exceed Range of Ohio Farm Soils (ROFS) limits for metals - cadmium (Cd), chromium (Cr), and lead (Pb) down to 4 feet and between 8 and 10 feet.

Table A-1

Summary of Previous Investigations at EKCO Housewares, Inc., Massillon, Ohio (continued)

Date	Performed by Whom	Scope of Investigation	Results of Investigation
July 1986	FBA	Monitor well R-1 and production wells W-1 and W-10 sampled.	Groundwater samples analyzed for total metals concentration of Cd and Pb. None detected.
Sept. 1986	FBA	18 soil samples taken at 3 locations in north tank farm down to 11 feet.	VOC analysis - up to 370 ppm VOC at surface and up to 0.9 ppm at 11 feet.
		8 groundwater samples taken from onsite wells and plant effluent outfall. Purpose: to determine if pumping aquifer and air stripping has reduced VOCs in soils.	VOCs were detected in every well but R-4. Maximum of 7.94 ppm were found in W-10 sample.
Dec. 1986	EKCO/Wadsworth OEPA	Side-by-side testing performed on onsite EKCO wells for vinyl chloride.	OEPA detected 0.001 - 0.012 ppm levels of vinyl chloride in three out of four monitor wells (R-1, R-2, R-4). EKCO/ Wadsworth analyses did not detect vinyl chloride.
Jan. 12-26, 1987	FBA-Phase II	To delineate extent of soil contamination beneath th lagoon. Evaluate impact of detected heavy metals on groundwater quality. 6 soil borings-installed 4 of 6 completed as monitor wells. 2 of 4 background (i.e., outside lagoon). 19 test borings in lagoon to 12 feet, with samples from 1-foot intervals.	Based on noncomposited samples analyzed for Priority Pollutant volatile compounds. 6 soil borings - up to 7.56 ppm VOCs outside lagoon. All lagoon samples analyzed for total Cd, Cr, and Pb. Some borings exceed ROFS limits at 12-foot intervals. 3 outside soil borings that were completed as monitor wells sampled for metals and purgeable organics. Found that groundwater complies with Safe Drinking Water Act standards. Groundwater concentrations of up to 1 ppd Cd, > ppb Cr, 8 ppb Pb, and 0.29 ppm VOCs were indicated.

Table A-1

Summary of Previous Investigations at EKCO Housewares, Inc., Massillon, Ohio
(continued)

Date	Performed by Whom	Scope of Investigation	Results of Investigation
April 1987	FBA	4 monitor wells in bedrock (D-series) Phase II were resampled.	Analyzed for purgeable organics. All showed VOCs. D-4 showed the maximum concentration of 256 ppm VOCs.
June 1987	OEPA	NPDES sewer system retested. Four discrete samples taken.	VOC analylsis had results similar to July 1986 EKCO/ Wadsworth testing.
Sept. 1987 - Dec. 1987	WESTON-Phase I	Perform interim measures, includes collecting groundwater sample from abandoned Ohio Water Company Well No. 4.	Analyzed for target compound list VOCs. Up to 2.9 ppb vinyl chloride and 4.7 ppb benzene.
		Sampling of onsite wells to establish baseline data for each well.	Analyzed for HSL compounds. VOCs found varying from non-detect to 780 ppm.
		Review area geology to determine regional and local groundwater flow conditions.	For unconsolidated materials, groundwater flow is toward southeast. For bedrock, pumping of wells W-1 and W-10 is causing a cone of depression and obscuring gradient.
		Conduct a groundwater utilization survey.	Commercial and municipal wells within a 1-mile radius of the site were located.
		Review plant records and other available documents.	Aerial photographs, tax maps, plant permits, and waste management files were reviewed.
May 1988-Dec. 1988	WESTON-Phase II	Monitor well installation to evaluate contamination plumes and effectiveness of groundwater recovery and treatment system and to establish compliance monitoring system for lagoon closure.	Installed 16 monitor wells, including one bedrock well (R-5), six interface wells (I-2, I-4, I-5, I-6, I-7, I-8), three piezometers (P-3, P-4, P-5), five lagoon wells (L-1 through L-5), and one shallow well (S-7).

Table A-1

Summary of Previous Investigations at EKCO Housewares, Inc., Massillon, Ohio
(continued)

Date	Performed by Whom	Scope of Investigation	Results of Investigation
May 1988- Dec. 1988	WESTON- Phase II	Surveying of site wells.	Determined complete horizontal and vertical locations of all 29 wells (observation and production). All north and east coordinates were measured from a USGS benchmark.
		Soil gas sampling to identify additional potential source areas for further investigation.	75 samples were collected at 50-foot intervals along the foundation of the facility and in suspected source areas and screened for target VOCs. Three major areas of elevated VOCS in shallow soils were identified, with TCE the most prevalent compound.
		Soil boring sampling to investigate the nature and extent of soil contamination at potential sources of groundwater contamination and to further assess the nature and extent of subsurface contamination beneath the lagoon.	14 soil borings were completed to the water table in areas where elevated VOCs were indicated by the soil gas survey. 9 lagoon soil borings were completed to characterize the lagoon. Samples were analyzed for VOCs, metals, and cyanides. Three major areas of elevated VOCs were identified, the same as in the soil gas survey. TCE and 1,1,1-TCA were the primary VOCs detected. Toluene and 1,2-dichloroethene were also detected. For the lagoon soil borings, TCE, 1,2-DCE, 1,1-DCA, and 2-butanone were the primary VOCs detected, up to 270 ppb total. The lagoon area had the highest concentrations of cadmium, chromium, and lead.

WESTON

Table A-1

Summary of Previous Investigations at EKCO Housewares, Inc., Massillon, Ohio (continued)

Date	Performed by Whom	Scope of Investigation	Results of Investigation
May 1988- Dec. 1988	WESTON- Phase II	Groundwater sampling to assess groundwater flow direction and extent of groundwater contamination.	Groundwater samples were collected from 21 wells and analyzed for VOCs and metals. The VOCs detected were TCE, 1,1,1-TCA, 1,2-DCE, 1,1-DCA, 1,1-DCE, total BTXE compounds, and vinyl chloride. TCE and 1,1,1-TCA were detected at the highest concentrations. The major plume was found between the lagoon and the north end of the plant. All metals were below applicable Federal standards for drinking water; however, manganese and iron were above secondary guidelines.
		Surface water sampling of nearby Newman Creek.	Surface water samples were collected upstream, adjacent to, and downstream of the lagoon at the plant outfall in Newman Creek and analyzed for VOCs and metals. Three compounds (1,2-DCE, 1,1,1-TCA, and TCE) were detected only in the outfall sample at less than the detection limits. All metals were below applicable Federal standards for drinking water; however, manganese and iron were above secondary guidelines.

Table A-1

Summary of Previous Investigations at EKCO Housewares, Inc., Massillon, Ohio
(continued)

Date	Performed by Whom	Scope of Investigation	Results of Investigation
May 1988-Dec. 1988	WESTON-Phase II	Stream sediment sampling of nearby Newman Creek.	Five stream sediment samples were collected in Newman Creek and analyzed for VOCs and metals. 1,1,1-TCA was detected in four samples below the detection limit. TCE and 2-butanone were detected in the outfall sample, with 2-butanone below the detection limit. The outfall sample also showed metal concentrations higher than the other samples.
		Aquifer testing to evaluate hydrologic connection between the bedrock aquifer and the overlying saturated, unconsolidated sediments.	A recovery/drawdown test was performed to determine aquifer properties. Transmissivities ranged from 0.018 to 0.102 ft^2/sec, and storativities ranged from 0.002 to 0.0001, which indicates a partially confined aquifer.

Table A-2

Plant Effluent Quality Ranges, EKCO Housewares, Inc., Massillon, Ohio

A. February 1972 - July 1975

Period	pH (S.U.)	Conduit Flow (MGD)	Copper (mg/L)	Nickel (mg/L)	Total Iron (mg/L)	Suspended Solids (mg/L)	Total Phosphate[a] (mg/L)	COD[a] (mg/L)	Total Solids[a] (mg/L)	Oil and Grease[b] (mg/L)
Prior to 1973	7.0-7.5	0.16-0.22	100-1,500	25-900	10-600	1-65	0.013-5.02	28-33	395-527	--
1973 - 1975	7-8	0.14-0.18	0- 800	0-450	25-200	1-20	0.001-0.017	26-67	505-717	2.5-10.0

B. July 1975 - January 1987

pH (S.U.)	Conduit Flow (MGD)	Copper (ug/L)	Nickel (ug/L)	Iron Fe, Dis (ug/L)	Residue T. NFLT (mg/L)	Oil and Grease (mg/L)
5.9-10.0	0.14-0.55	0-550	0-250	50-520	0-20	0-20

[a]Analysis required once every 6 months.
[b]Started July 1974.

WESTON

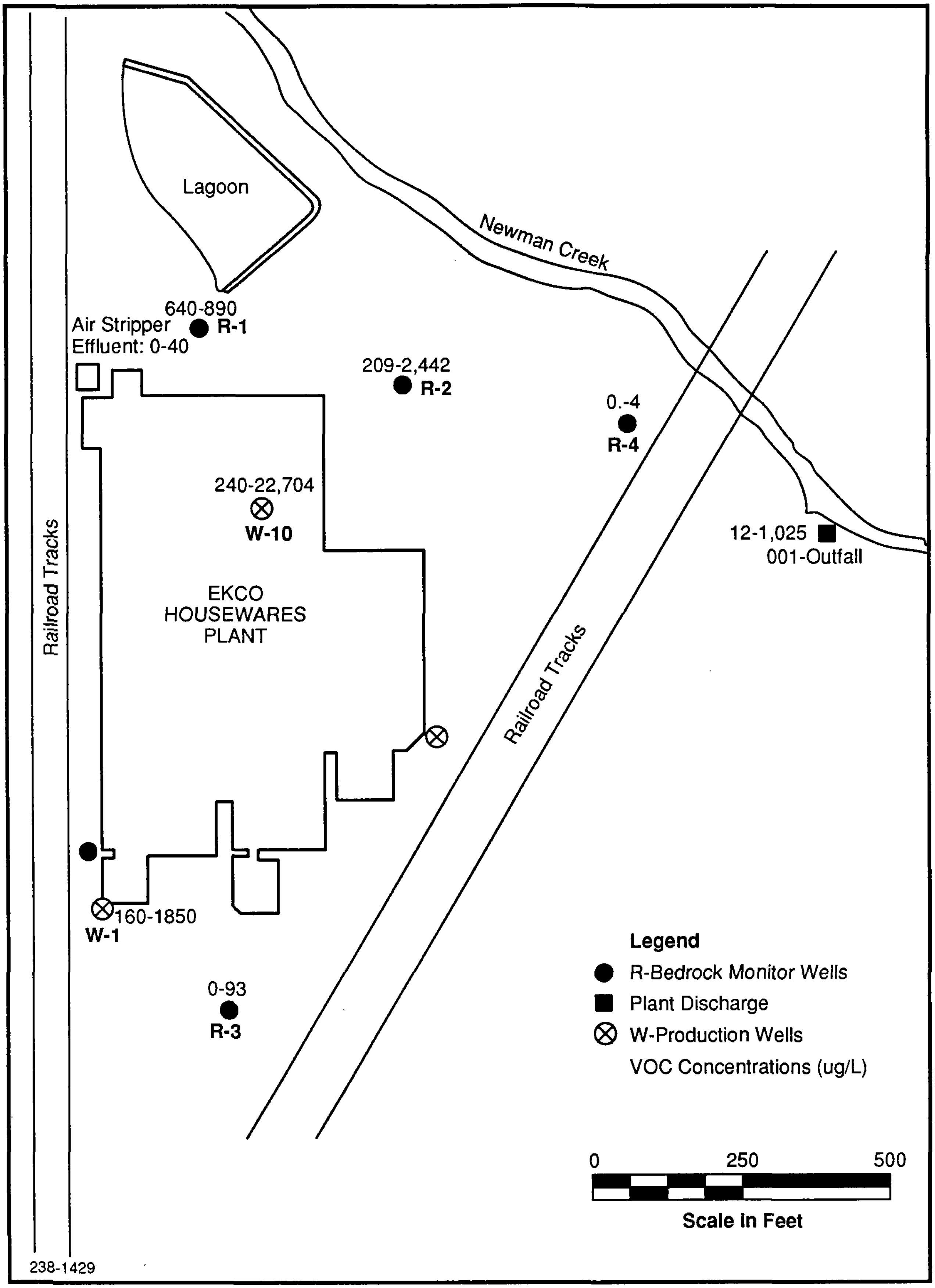

FIGURE A-1 UPPER AND LOWER VOC CONCENTRATION LIMITS FROM GROUNDWATER RECLAMATION REPORTS MARCH 1986 TO SEPTEMBER 1988 EKCO HOUSEWARES, INC., MASILLON, OHIO

APPENDIX B

DRILLER'S LOG FOR RECOVERY WELL W-1

THE OHIO DRILLING CO.

INCORPORATED

MASSILLON, OHIO

DRILLED FOR Massillon Aluminum Company, Massillon, Ohio HOLE NO. 1 - 12" Well

DRILLED BY Herb Dyer DRILLER COMPLETED April 14, 1951

LOCATION South side of Plant

THICKNESS OF STRATA	STRATA	TOTAL DEPTH	HEAVED	WATER FROM SURFACE
19 ft.	Clay, stones	19 ft.		
6 ft.	Clay	25 ft.		
46 ft.	Shale	71 ft.		
12 ft.	Yellow sandrock	83 ft.		28 ft.
13 ft.	Gray shale	96 ft.		28 ft.
49 ft.	Yellow sandrock	145 ft.		28 ft.
23 ft.	White sandrock	168 ft.		28 ft.
32 ft.	Shale, sandy shells	200 ft.		28 ft.
25 ft.	Shale	225 ft.		28 ft.

Total depth 225 ft.

Well cased with 29'-3" of 12" - 51 lb. steel drive pipe with steel drive shoe.

Initial test 125 g.p.m. at 110 ft. pumping level

Shot well as follows:

50 lb. 60% Dynamite at 160 ft.
50 lb. 60% Dynamite at 145 ft.
50 lb. 60% Dynamite at 130 ft.
50 lb. 60% Dynamite at 115 ft.

Final test 500 g.p.m. at 105 ft. pumping level
550 g.p.m. at 120 ft. pumping level

WESTON

APPENDIX C

RFI/CMS WORK PLAN
QUALITY ASSURANCE PROJECT PLAN (QAPP)

QUALITY ASSURANCE PROJECT PLAN

EKCO Housewares, Inc.
Massillon, Ohio

M. N. Bhatla, Ph.D., P.E.
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SECTION 1

TITLE AND APPROVAL PAGE

FOR RFI/CMS WORK PLAN QUALITY ASSURANCE PROJECT PLAN

______________________ EKCO Housewares Project Manager	__________ Date

______________________ Harold G. Byer Roy F. Weston Project Manager	__________ Date	______________________ OEPA Project Manager	__________ Date
______________________ Weston QA Officer	__________ Date	______________________ OEPA QA Officer	__________ Date

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SECTION 3

PROJECT DESCRIPTION

This Quality Assurance Project Plan (QAPP) has been prepared to detail the procedures for execution of a field investigation to gather pertinent data specified in the RFI/CMS Work Plan at the EKCO Housewares site located in Massillon, Ohio.

This QAPP contains elements of the Sampling and Analysis Plan, the Data Management Plan, and the Laboratory Quality Assurance Plan. The objectives of these plans are to produce properly documented RFI/CMS Work Plan field and laboratory data of appropriate quality and to ensure the health and safety of field personnel during the field effort.

This document will be used by WESTON project technical personnel to execute the RFI/CMS Work Plan field investigation and will provide a quality assurance guideline for monitoring the project.

3.1 SITE BACKGROUND

3.1.1 General

The EKCO Housewares Inc., (EKCO) facility is located at 359 State Avenue Extension N.W., Massillon, Ohio, 44648. This facility is located on approximately 13 acres, 500 feet north of State Avenue Extension and 1,500 feet west of the Tuscarawas River in the northwest portion of Massillon, Stark County, Ohio. Figure 3-1 shows the location of the facility on a 7.5-minute USGS Massillon quadrangle map of Stark County. The area surrounding the site is largely urban and industrial. Newman Creek, which flows eastward into the Tuscarawas River, borders the northern and northwestern boundaries of the facility. The

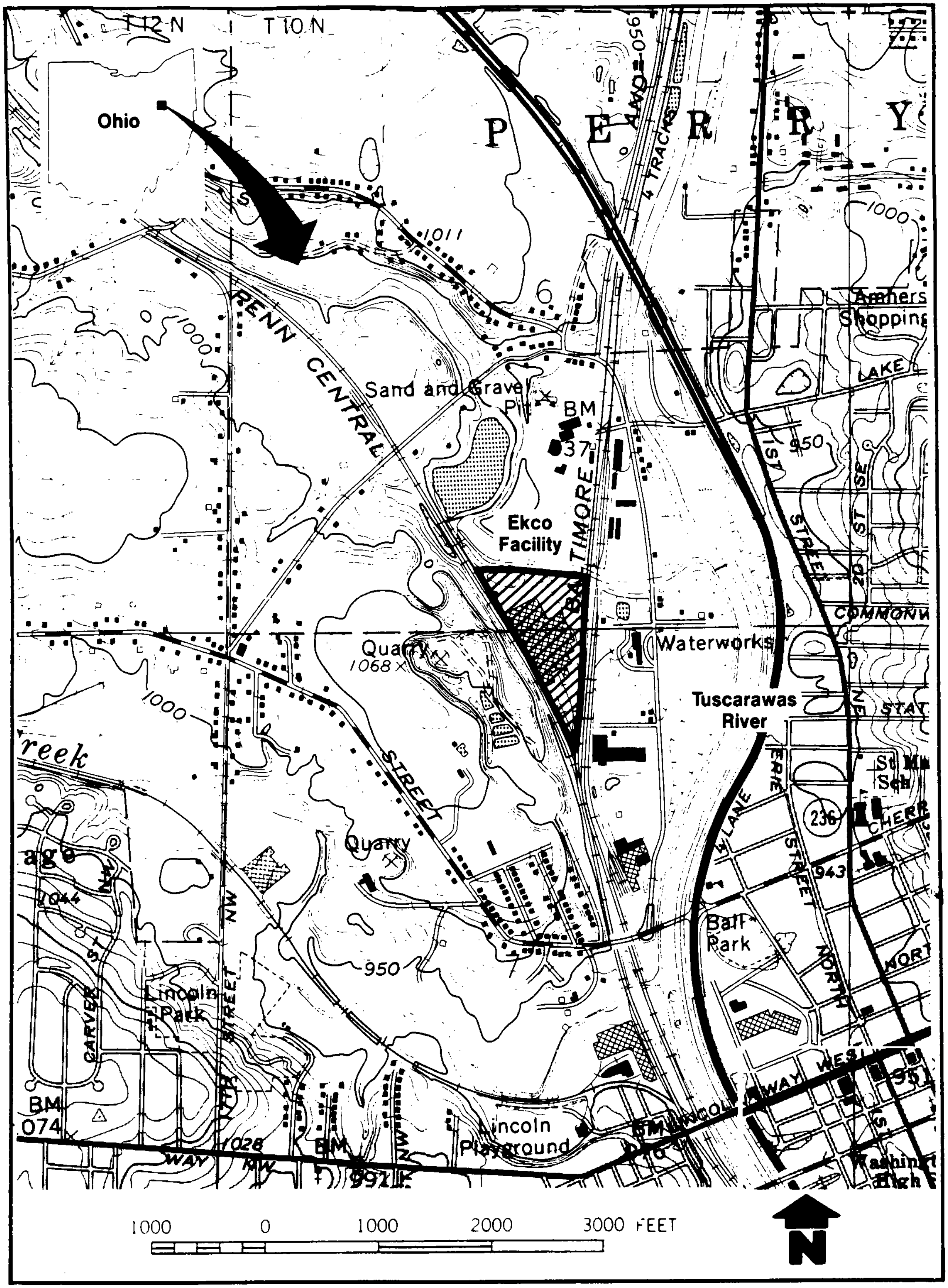


FIGURE 3-1 SITE LOCATION MAP
EKCO HOUSEWARES, INC., MASSILLON, OHIO
(Ref. 7.5 Minute Massillon Quad, Ohio, 1978)

Penn Central and Baltimore and Ohio Railroads border the facility to the east and west, respectively. Figure 3-2 shows the layout of the EKCO facility. The plant consists of several buildings comprising a total area of approximately 240,000 square feet. The buildings are subdivided into office space, warehouses, machine shops, coating process lines, and packaging and shipping areas.

The plant was built circa 1900 and in 1945 began producing aluminum cookware. In 1946, the plant started manufacturing pressure cookers and stainless steel cookware. In 1951, during the Korean conflict, the plant produced 90 mm and 105 mm cartridge cases for the U.S. Government. Currently, the plant is engaged in the manufacture of cookware from metal pressing and coating operations, producing nearly 26 million pans per year and employing about 350 people in a 24-hour per day, 5-day per week operation.

3.1.1.1 Waste Management Description and History

There is no effluent waste treatment handling at this facility. Only noncontact process cooling water is currently discharged to an outfall at Newman Creek. This discharge is sampled and analyzed every month, and the results of the analysis are furnished to EPA and to the Ohio EPA (OEPA) under the NPDES Permit requirements. Currently, all hazardous wastes, such as spent trichloroethylene (TCE), silicone wastes, and used oil wastes, are stored in labeled 55-gallon drums on a concrete apron at the northwest end of the plant. The plant processes include several large commercial-type spray degreasers that generate a substantial amount of spent trichloroethylene and concentrated trichloroethylene still bottoms. A total of 15,730 gallons (191,174 lb) of waste materials was generated in 1985. Prior to 1985, this waste material was sent to an authorized facility for incineration every 2 months (U.S. EPA I.D. Number

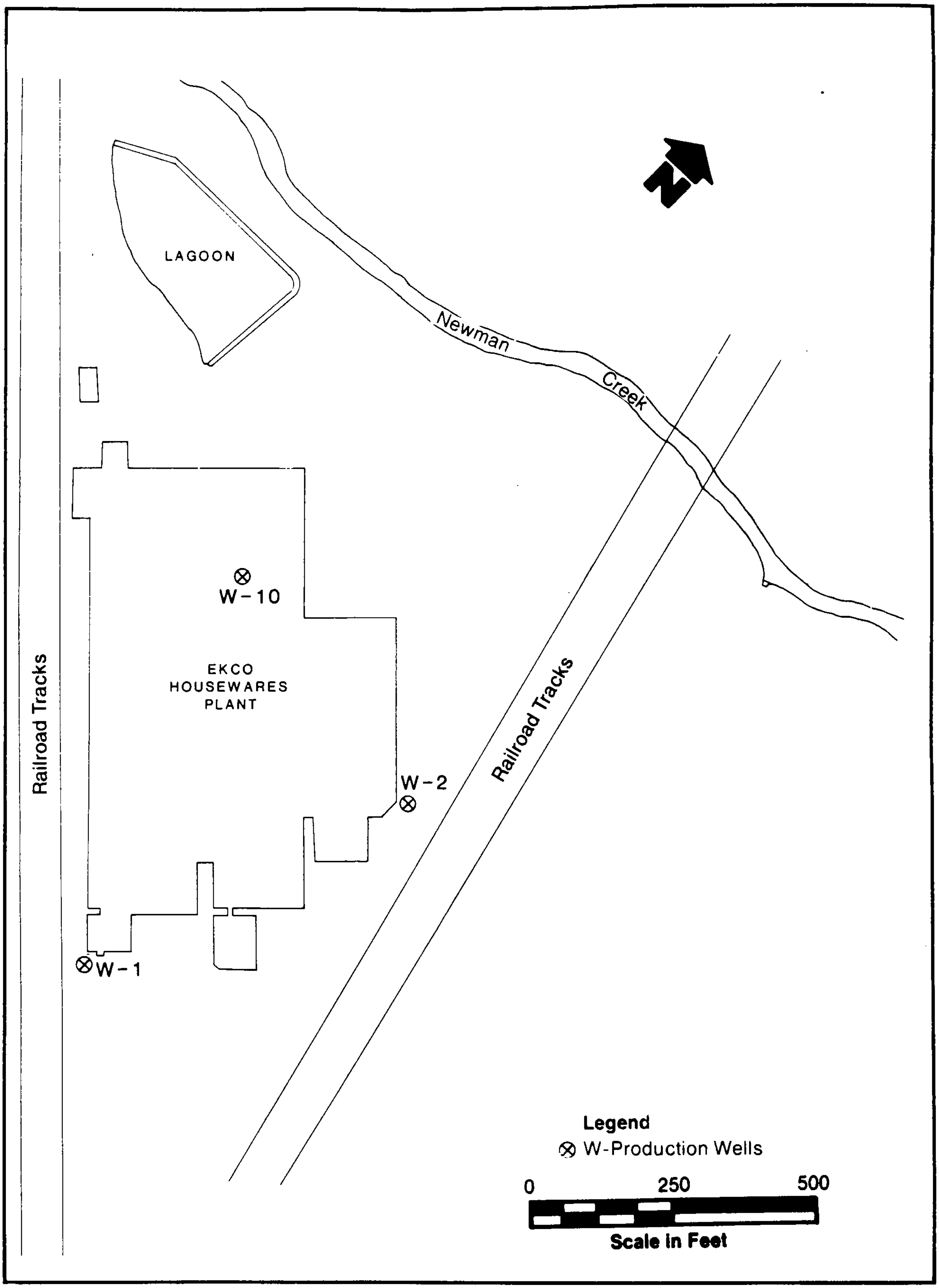


FIGURE 3-2 SITE DIAGRAM SHOWING LOCATIONS OF PRODUCTION WELLS EKCO HOUSEWARES, INC., MASSILLON, OHIO

OHDO 48415665). Starting in 1985, the spent concentrated degreaser stillbottoms were sent to a reclamation service (U.S. EPA I.D. Number OHD 980587364) for reconstitution and reuse.

In 1971, an application was presented to the Ohio Water Pollution Control Board for a discharge permit. Production procedures and waste abatement practices were outlined. Waste abatement was practiced in the plant by segregating specific wastes and directing those wastestreams to a nonoverflowing evaporation lagoon. The process discharge produced was mixed with excess groundwater, cooling water, and stormwater, and was discharged into Newman Creek.

When copper plating and printing operations were in use after 1954, all process water, including alkaline cleaning rinse waters, boiler blowdown, and deionizer water (hydrochloric acid and sodium hydroxide), was piped to the lagoon. Approximately 0.2 mgd of wastewater potentially containing heavy metals, solids, and alkalines was discharged to the lagoon when the plating line was in operation until November 1978. Plant discharge reports from February 1972 through November 1978 indicate that the pH of the discharge to the lagoon was in the range of 6.0 to 9.5.

3.1.2 Site Geology

3.1.2.1 Fill Materials

The EKCO facility was constructed on top of fill material that ranges up to approximately 25 feet in thickness. The estimated thickness of fill material on the site is based upon available soil boring logs and well logs. The fill, predating the EKCO facility, was used to level the site and covers a large portion of the EKCO property to the north, east, and southeast of the building. The fill is thickest around the lagoon and southeast of the lagoon.

The fill deposits consist of a wide variety of materials ranging from construction debris to fly ash. At the surface, the fill is a very hard, compacted material with low permeability. The fill is less compacted with depth. Much of the fill area is used for a parking lot. Natural, unconsolidated deposits underlie the fill; based upon current data, fill deposits are not in contact with bedrock.

3.1.2.2 Unconsolidated Deposits

Directly underlying the fill materials are unconsolidated deposits of variable thickness. The unconsolidated deposits are primarily glacial outwash consisting of medium sands and gravels with some interbedded silts and clays.

The unconsolidated deposits vary in composition both vertically and horizontally. This variation causes significant inconsistencies in vertical and horizontal permeability.

The unconsolidated deposits thicken on the site from west to east, ranging in thickness from 4 feet to 150 feet. To the west (offsite), the unconsolidated deposits become progressively thinner, reaching zero thickness approximately 200 feet west of the site. To the east, the deposits thicken toward the Tuscarawas River.

3.1.2.3 Bedrock

Directly underlying the unconsolidated deposits is interbedded sandstone and shale bedrock. The EKCO site lies on a bedrock high that slopes to the east and northeast at approximately 16 degrees. The slope of the bedrock surface is based upon boring logs.

3.1.3 Hydrogeology

The hydrogeologic system at EKCO has been subdivided into three interconnected zones: the fill, the unconsolidated glacial deposits, and the bedrock zones. Each of these zones has unique hydraulic properties, and each is affected by EKCO and the nearby Ohio Water Service (OWS) pumping in different ways and to a different extent.

3.2 PROJECT OBJECTIVES

The objectives for the preparation of this RFI/CMS Work Plan include:

- Fulfillment of the Scope of Work requirements for describing current facility conditions and presenting the preinvestigation evaluation of corrective measures technologies, referred to as Tasks 1 and 2 of the Scope of Work.
- Description of the RFI/CMS activities in sufficient detail to complete all tasks presented in the Scope of Work attached to the Consent Order.
- Outlining a program to collect data and complete an evaluation and selection of the appropriate corrective measures necessary to protect human health and the environment in a cost-effective manner.

The QAPP is intended to address the procedures for each field activity and the analytical work necessary to accomplish the above objectives.

3.3 SCOPE OF WORK OF THE RFI/CMS

The proposed RFI/CMS at the EKCO facility is a pro-active step to address potential environmental concerns at the site. Since 1987, three environmental programs have been implemented at this site:

- Interim measures.
- Lagoon investigation of the regulated unit.

- Groundwater quality assessment.

Therefore, the RFI and CMS represents the next logical step in the investigation of the nature and extent of contaminants and the evaluation of necessary corrective measure to protect human health and the environment.

Based on the results of the groundwater quality assessment and other above mentioned investigations, the scope of the RFI has been focused to address soils and groundwater (environmental media) and volatile organic compounds and heavy metals (constituents). Based on the past environmental studies performed at the site, a list of the contaminants of concern was developed and is presented as Table 3-1.

3.3.1 Monitor Well Installation

Thirteen additional groundwater monitor wells will be installed, using cable tool drilling methods, at 10 locations to characterize water quality and assess the hydrogeologic conditions between the EKCO site and OWS wells 1, 2, and 3.

3.3.2 Groundwater Sampling

The 13 newly installed monitor wells, eight deep unconsolidated zone wells, I-9 through I-16, and three shallow wells S-4, S-11, and S-12, and two bedrock wells, R-7 and R-10, will be sampled. The groundwater samples will be analyzed for VOCs and metals. Additionally, existing monitor wells other than those sampled quarterly under ongoing RCRA and NPDES programs will be sampled and analyzed semi-annually for VOCs only, since heavy metals in the previous groundwater quality analyses have not indicated elevated metals concentrations in the groundwater. Table 9-4 indicates which wells will be sampled and which group of constituents will be analyzed.

Table 3-1

Contaminants of Concern

Organic (detected in groundwater and/or surface soils and/or lagoon sludges/subsoils)

- Trichloroethylene (TCE)
- Trichloroethane (TCA)
- Dichloroethylene (DCE)
- Dichloroethane (DCA)
- Dichlorobenzene
- Vinyl Chloride
- 2-Butanone (Methyl Ethyl Ketone-MEK)
- Acetone
- Carbon Tetrachloride
- Chloroform
- Methylene Chloride
- Chloromethane

Inorganic (detected in lagoon sludges/subsoils at elevated levels)

- Cadmium (total)
- Chromium (total)
- Lead (total)

3.3.3 Subsurface Soil Sampling

Further characterization of potential sources of hazardous constituents to the groundwater is necessary. The groundwater quality assessment has identified four onsite areas that may continue to be sources of contaminants to the groundwater: the active tank area on the south end of the plant; the abandoned tank area on the north end of the plant near D-4-30; the sump at production well W-10 inside the plant; and the lagoon. Since the lagoon is being addressed as a regulated unit, it will not be considered during the RFI. To further define the three remaining areas, three to four additional soil borings will be placed in each of these areas. Soil samples will be collected continuously at each boring location and will be logged by the onsite geologist. Up to three samples will be retained from each boring for chemical analysis. Samples for analysis will be collected from depths of 2 to 4 feet, 6 to 8 feet, and 10 to 12 feet below ground surface. The sampling intervals may be modified at the discretion of the onsite geologist based upon organic vapor detection, discoloration, odors, or recovery. Samples will be analyzed for VOCs.

SECTION 4

PROJECT MANAGEMENT PLAN

4.1 PROPOSED PROJECT PERSONNEL

The organization of the project responsibilities described below are also presented in Figure 4-1, the Project Responsibilities Chart.

4.1.1 Project Director

M. N. Bhatla, Ph.D., P.E., will be responsible for project objectives, scope, budget, and quality of the submittals.

4.1.2 Project Manager

Harold G. Byer, Jr., will be responsible for planning, coordinating, integrating, monitoring, and appraising (i.e., managing) all project activities.

4.1.3 Quality Assurance Coordinators

Michael Corbin, P.E., will be responsible for the accuracy and precision of field-generated sample data and information. He will have the authority to impose proper procedures or to halt an operation. His duties include QA review and approval of sampling procedures, field documentation, and all technical data.

4.1.4 Technical Managers

Randall McAlister, P.G., and Augustus Mergenthaler, P.E., will be responsible for the identification and ultimate resolution of technical problems and the technical coordination of the

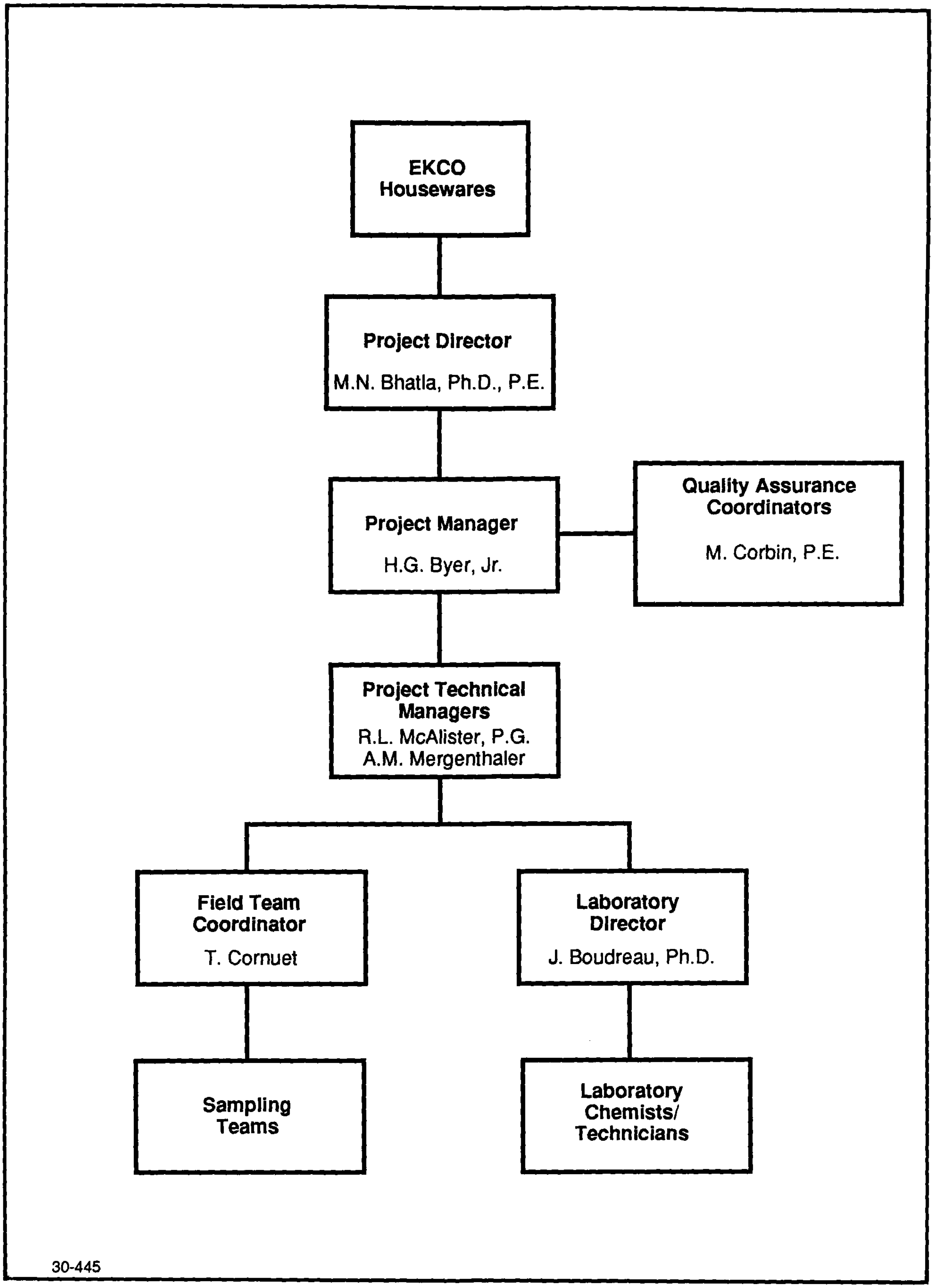


FIGURE 4-1 PROJECT RESPONSIBILITIES CHART

field efforts, hydrogeological evaluation, and contamination assessment.

4.1.5 Project Field Team Leader and Safety Coordinator

Thomas Cornuet will be responsible for ensuring that all procedures for the field activities are executed in the proper manner and are documented.

The Field Safety Coordinator will be responsible for (1) having an up-to-date Health and Safety Plan in place; (2) overseeing that subcontractors adhere to the HSP; (3) training of all personnel involved in Health and Safety procedures; (4) control in emergencies; (5) a logbook of activities; and (6) supervising the decontamination area and work site setup.

4.1.6 Laboratory Director

John P. Boudreau will be responsible for ensuring that all laboratory procedures are executed in a proper and timely fashion.

4.2 PROJECT COORDINATION

4.2.1 Field Communications

WESTON field personnel will direct all agency requests for changes in scope or operations to the WESTON Project and Technical Managers. Any of these requested changes will then be discussed with the client for final resolution. Only the WESTON Project Manager (or WESTON Technical Managers in the absence of the WESTON Project Manager) will authorize WESTON field personnel to change either the Scope of Work or methods of implementation with the client's approval.

Table 5-1

Summary of Precision, Accuracy, and Completeness Objectives

Parameter	Method	Water Accuracy (%) Mean	L.L.	U.L.	Precision % RPD Limit (%)	Completeness (%)
Metals		Mean	L.L.	U.L.		
Aluminum[a]	6010	99.8	84.5	115.5	20	95
Antimony	6010	99.5	83.0	117.0	6.7	95
Arsenic	7060	99.0	75.6	124.5	16.5	95
Barium	6010	101.0	90.1	109.9	14.8	95
Beryllium	6010	100.4	88.0	112.0	17.7	95
Cadmium[a]	6010	102.7	89.4	110.6	20	95
Calcium	6010	103.0	89.6	110.4	11.5	95
Chromium	6010	104.5	90.0	110.1	16.9	95
Cobalt	6010	100.6	86.0	114.0	13.5	95
Copper[a]	6010	100.1	89.9	110.2	20	95
Iron	6010	102.4	89.9	110.1	17.8	95
Lead	6010	100.9	89.6	110.4	19.4	95
Magnesium	6010	100.8	89.3	110.7	11.4	95
Manganese	6010	102.1	90.1	109.9	12.2	95
Mercury	7471	101.0	85.0	115.0	20	95
Nickel	6010	103.6	109.9	90.1	19.2	95
Potassium[a]	6010	99.7	90.6	109.4	20	95
Selenium	7760	100.0	83.0	117.0	20	95
Silver[a]	6010	103.2	91.2	108.8	20	95
Sodium	6010	100.6	89.6	110.4	10.8	95
Thallium[a]	6010	100.4	89.2	110.8	20	95
Vanadium	6010	100.1	89.9	110.1	14.8	95
Zinc	6010	102.0	88.0	112.0	20	95
Matrix Spike Compounds						
1,1-Dichloroethane[ab]	8240	61-145			14	95
Trichloroethene[ab]	8240	71-120			14	95
Chlorobenzene[ab]	8240	75-130			13	95
Toluene[ab]	8240	76-125			13	95
Benzene[ab]	8240	76-127			11	95
Toluene-d_B[ab]	8240	88-110			--	95
4-Bromoflourobenzene[ab]	8240	86-115			--	95
1,2-Dichloroethane-d_4[ab]	8240	76-114			--	95

[a]The methods accuracy limits are used because lab statistical limits exceed the method control limits.
[b]The methods precision limits are used because lab statistical limits exceed the method control limits.

SECTION 5

QUALITY ASSURANCE AND QUALITY CONTROL (QA/QC) OBJECTIVES

The specific QA/QC objectives for this project are summarized in Table 5-1. The objectives are divided into three groups briefly described below.

- Precision - The degree of agreement between the numerical values of a set of duplicate samples performed in an identical fashion constitutes the precision of the measurement. Precision will be reported as relative percent difference as expressed by the following formula:

$$\% \text{ RPD} = \frac{(C_1 - C_2)}{(C_1 + C_2)/2} \times 100\%$$

- Accuracy - Accuracy is the measure of a result to the accepted (or true) value. Accuracy is assessed by means of reference samples and percent recoveries. Error may arise from personal, instrumental, or methods factors. Analytical accuracy is expressed as the percent recovery of an analyte that has been added to the sample (or standard matrix, i.e., blank) at a known concentration before analysis and is expressed by the following formula:

$$\text{Accuracy} = \% \text{ Recovery} = \frac{A^T - A^O}{A^F} \times 100\%$$

Where:

A^T = Total amount found in fortified sample.
A^O = Amount found in unfortified sample.
A^F = Amount added to sample.

The fortified concentration may be specified by contract or laboratory quality control requirements, or may be determined relative to background concentrations observed in the unfortified sample. In the latter case, the fortified concentration should be different enough (2 to 5 times higher) from the background concentration to permit a reliable recovery calculation.

4.2.2 Deliverables Pathway

All project deliverables will be sent to the client (or regulatory agencies at the request of the client) by the Project Manager. No field notes or preliminary information will be sent to the regulatory agencies without authorization from the Project Manager and the client.

- Completeness - Completeness is a measure of the relative number of analytical data points that meet all the acceptance criteria for accuracy, precision, and other criteria required by the specific methods factors. The level of completeness can also be affected by loss or breakage of samples during transport, as well as external problems that prohibit collection of the sample. The WESTON QA objectives for completeness is to have 80 percent of the data usable without qualification. The ability to meet or exceed this completeness objective is dependent on the nature of samples submitted for analysis. If data cannot be reported without qualifications, project completion goals may still be met if the qualified data, i.e., data of known quality even if not perfect, is suitable for specified project goals.

To meet these objectives, the field work and laboratory analysis will follow the standardized methods or procedures described in Sections 7 and 11.

SECTION 6

QUALITY ASSURANCE/QUALITY CONTROL

6.1 FIELD INVESTIGATION PROCEDURES

6.1.1 Monitor Well Installation

Prior to the start of drilling activities, the proposed well locations will be staked, cleared of underground obstructions and utilities, and then approved by representatives of EKCO.

Drilling methods are described in Subsection 6.1.1.1, and well construction is described in Subsection 6.1.1.2. Monitor well development is described in Subsection 6.1.1.3.

Following well installation and development, the top of casing and surface elevations for all new wells will be surveyed relative to the mean sea level datum. Water level measurements will be made, and all new monitor wells will be sampled.

6.1.1.1 Drilling Methods

Borings will be completed using a cable tool rig with an 8-inch ID bit. No drilling fluids will be used except potable water.

Prior to the start of drilling, all downhole equipment (the drilling rods, rig tools, and other) will be decontaminated according to the procedures outlined in this section.

Soil cuttings generated from drilling activities are not expected to be contaminated. Cuttings will be spread at the site or will be removed from the site in order to leave the area in a neat condition.

6.1.1.2 Monitor Well Construction

All newly constructed monitor wells will be constructed of 4-inch diameter wound-wire type 304 stainless steel screens, stainless steel risers, and a protective black iron surface casing with lockable cap. The shallow monitor wells will have 10-foot screens installed into the first encountered water-bearing zone (in the unconsolidated sediments). Similar construction of the bedrock interface wells will be used, except that the 10-foot screens will be installed to the bedrock/ unconsolidated sediment interface. Wells near the OWS wellfield will be constructed with screens at depths wihtin the reported screen intervals of the OWS wells.

At the determined depth in the shallow wells, the well screen and riser will be installed and the drive casing withdrawn to the top of the screen. Silica sand will be used to backfill the annular space after the casing is withdrawn. When plumbing the hole indicates that the sand pack is at the desired height, a 2-foot bentonite pellet seal will be placed on the top of the sand pack as the casing is gradually withdrawn. The shallow wells will be completed by gravity-feeding a neat cement mixture into the remaining annular space. After completion, the grout will be checked for settlement and more neat cement added, if needed. The upper 2.5 feet of annular space will be filled with a cement/sand mixture and a protective casing will be installed.

Similar well installation techniques will be used for all other monitor interface wells. A natural sand pack will extend approximately 2 to 4 feet above the screen, and a bentonite slurry will be tremied from the top of the sand pack as the drive casing is gradually withdrawn so that no collapse of the borehole occurs. These wells will be completed by treming a neat cement mixture to the bottom of the hole to displace the water in the annular space. As the drive casing is slowly withdrawn, the level of the grout will be maintained inside the drive casing by pumping additional grout to the bottom of the hole. A protective black iron casing will then be installed.

All data will be recorded on the well construction summary form (Figure 6-1).

6.1.1.3 Monitor Well Development

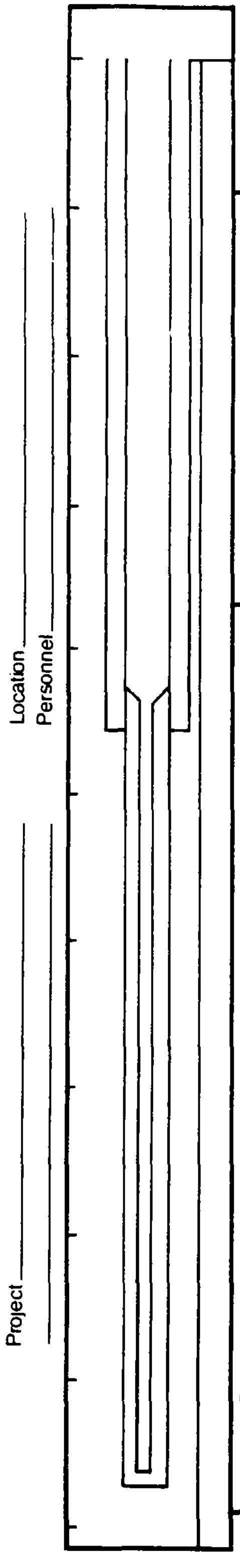
Each new well will be developed approximately 1 day after installation with a pump or bailer until a steady flow of clear water is obtained and until at least five well volumes are removed. The pump intake will be moved through the length of the screen or open borehole during development. If a sufficient head cannot be maintained during pumping, a bailer and surge block method will be employed. All onsite purge water will be collected in a tanker provided by EKCO and taken to the onsite air stripper for processing and discharge.

All development equipment will be decontaminated prior to use in each well in accordance with procedures described in this section.

6.1.2 Groundwater Sampling

The objective of the sampling task is to characterize the groundwater contaminants, to determine the direction of any contaminant migration from the site, and to delineate the contaminant plume. Groundwater samples will be collected from the wells specified in Table 9-4. These samples will be submitted to WESTON's Analytics Division for analyses of VOCs and metals as specified in Table 9-4. Additionally, samples will be collected from all monitor wells (not routinely sampled) and analyzed for VOCs on a semi-annual basis. Groundwater samples will be collected from each well during each sampling event for field analyses measurements of pH, Well ____________

Well Construction Summary



Location or Coords: ____________ Elevation: Ground Level ____________

____________ Top of Casing ____________

Drilling Summary:

Total Depth ____________

Borehole Diameter ____________

Driller ____________

Rig ____________

Bit(s) ____________

Drilling Fluid ____________

Surface Casing ____________

Well Design:

Basis: Geologic Log ____ Geophysical Log ____

Casing String(s): C Casing S Screen

Casing: C1 ____________

C2 ____________

Screen: S1 ____________

S2 ____________

Centralizers ____________

Filter Material ____________

Cement ____________

Other ____________

Construction Time Log:

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling:				
Geophys. Logging:				
Casing:				
Filter Placement:				
Cementing:				
Development:				
Other				

Well Development:

Comments:

FIGURE 6-1 WELL CONSTRUCTION SUMMARY FORM

temperature, and specific conductance. After initially calibrating the instruments according to the methods detailed in this section, measurements will be taken and the data will be recorded in the field logbooks. The instrument probes will be flushed with distilled/deionized water between sample measurements.

All data will be recorded on the well sampling forms (Figures 6-2 and 6-3).

6.1.2.1 Monitor Well Sampling

The objective of this task is to obtain representative ground-water samples. Wells suspected of having low contaminant concentrations will be sampled prior to those suspected of having medium or high contaminant concentrations. The field measurements of the water levels in the wells will be used to prepare separate potentiometric maps for the bedrock and unconsolidated deposits.

The procedure for sampling monitor wells is as follows:

1. Scan the area around the well with HNu/OVA. Record external air measurements in logbook.
2. Open well cap and monitor downhole and ambient air quality utilizing monitoring equipment.
3. Record the following well information and measurements on well sampling forms (Figures 6-2 and 6-3):
    a. Well identification and location (at the time of each sampling).
    b. Well integrity.
    c. Height of casing above ground surface (in feet).
    d. Downhole and ambient air readings detected with HNu/OVA (at the time of each sampling).
    e. Depth of water level (feet) from the top of casing (at the time of each sampling).

GENERAL INFORMATION

Date: ____________
Weather: ____________

Well Number (Purge Well): ______________________________
Reported by: ______________________________
Sampling Team: ______________________________

WELL MEASUREMENTS

Other Comments:

Protective Casing: Intact/Damaged ______________________
Locked: Yes/No Key#: ______ ______________________
Concrete Base: Intact/Damaged ______________________
Casing Diameter: ____________ ______________________
Stick-Up Height: ____________ ______________________

HNu/OVA Readings
Initial: ____________ ______________________
During Purging: ____________ ______________________
During Sampling: ____________ ______________________

Floating Layer: Yes/No
Thickness: ____________ ______________________
Sampled: Yes/No

Depth to Water*: ____________ ______________________
Depth to Well Bottom*: ____________ ______________________
Column of Standing Water: ________ ______________________
Well Volume: ____________ ______________________
(4":0.65, 6":1.47, 8":2.61) ______________________
Well Evacuation Method: ________ ______________________
(Bailer, Pump, Other) ______________________
Pump Setting Depth(s)*: ____________ ______________________

Begin Purge Time: ____________ ______________________
Purging Rate (gpm): ____________ ______________________

*From Top of Casing

Other Comments: ____

FIGURE 6-2 WELL SAMPLING SHEET

Date: ____________
Well No. ____________

Observation Well(s)

	Purge Well:	1 Well #:	2 Well #:	3 Well #:
Pre-Purge:				
Depth to Water*/Time				
During Purging:				
Depth to Water*/Time				
Depth to Water*/Time				
Depth to Water*/Time				

End of Purge Time: ____________
Volume of Water Evacuated: ____________
# of Drums Filled: ____________

Recovery Rate After Purging:	Purge Well:	1 Well #:	2 Well #:	3 Well #:
Depth to Water*/Time				
Depth to Water*/Time				
Depth to Water*/Time				
Estimated Yield (gpm)				

SAMPLE INFORMATION	(Pre-Purge)	(During Purging)		(End Purge)
Time				
Temperature °C:				
pH:				
Specific Conduct				
Odor: Yes/No:				
Turbid: Yes/No:				
Color:				

Other Comments: ____________

FIGURE 6-3 WELL SAMPLING SHEET

Water level measurements will be taken to the nearest 0.01-foot with respect to mean sea level on top of the well casing. All measuring devices used in the well will be washed with laboratory-grade detergent solution and thoroughly rinsed with distilled water prior to reuse. The depth to the top of the water will be subtracted from the total casing depth to determine the height and, subsequently, the volume of standing water in the casing.

f. Total depth of well and depth to top of sediment layer, if present (in feet).

g. Total volume of standing water in the well.

4. Take a sample for dense, nonaqueous-phase liquids in the bottom of all onsite wells to be sampled using a BAT Envitech Hydroprobe Sampler. If the visual inspection and/or head space analysis of the vial indicates the presence of a dense, nonaqueous-phase liquid, then the groundwater will not be sampled in this well(s). The BAT sample vial will then be sent to the laboratory for volatile organic analysis. The hydroprobe will be decontaminated between samples by steam-cleaning the outside of the sampling unit and activation tubing. The hypodermic needle and sampling vial will be replaced between wells.

5. Evacuate a minimum of three well volumes of water from shallow and deep wells using a submersible or suction pump. If the well recharges fast enough during purging so that the water level is not drawn down or drawdown is slow, place the pump intake near the top of the water level and lower as needed. This will ensure that the water near the top of the casing that will be sampled by the bailer is replaced. Record the volume of water removed and the elapsed time of purging. The purge water will be discharged into a tanker and taken to the air stripper for processing.

6. Allow well to recharge. Record time required for recharge.

7. Use a dedicated, precleaned, stainless steel or Teflon bottom-filling bailer with stainless steel leaders to obtain the sample. Attach a braided polyethylene cord to the bailer and slowly lower the bailer into the well. After the bailer has filled, slowly raise the bailer from the well. Do not allow the bailer to touch the ground. Fill the VOA bottle first, checking to confirm that the vial is free of all air bubbles. The sample for dissolved metals will be filtered through a 0.45-micron filter prior to preservation. Fill the

remaining sample containers by splitting each bail full of water among the various sample jars. Add preservatives to the sample containers, as appropriate. Appropriately discard the cord after each use.

8. Seal and label the sample bottles. Record all pertinent information on each sample (color, odor, sheen, etc.) in the field sampling notebook.

9. Record the field parameters (pH, electric conductivity, and temperature) at each sample collection point.

10. Replace well cap. Make sure well is readily identifiable as to the source of the sample. Well sample analysis parameters, sample volumes, and container types are given in this section.

11. Pack samples for shipping as directed in Section 7. Add ice and vermiculite and seal the cooler for shipment.

12. All sampling equipment will be decontaminated after sampling as detailed in this section to prevent cross-contamination.

6.1.2.2 Site Production Well Sampling

Groundwater sampling of the site production wells will be accomplished using the existing permanent pumps. The static pumping rate will be measured. Wells that are on-line at the time of sampling will be purged by allowing water to flow through the sampling valve for 1 minute. Wells not on-line but serviceable at the time of sampling will be restarted by a EKCO representative and allowed to run for approximately 15 minutes prior to opening the sampling valve. After the wells have been purged, each sample container will be gently filled from the pump line taking care to avoid aeration and turbulence in the sample. A clean glass rod may be used, if necessary, to conduct the flow into the sample container. Samples will be labeled and handled as stated in Subsection 6.1.2.1.

6.1.2.3 Bedrock Monitor Well Sampling

Groundwater samples will not be collected from the dedicated pumps in the R-1 through R-4 monitor wells. The pumps will first be pulled from these wells as needed and then sampled in the same manner as listed in Subsection 6.1.2.1.

6.1.3 Soil Borings Sampling

Soil borings will be advanced in areas of suspected contamination in order to assess the quantity and vertical distribution of the VOAs present in the soil.

At each location, samples will be collected from depths of 0 to 2 feet, 4 to 6 feet, and 10 to 12 feet below ground surface or at the discretion of the onsite geologist based upon vapor detection, discoloration, or other field indicators. The samples will be analyzed for VOAs as specified in Table 9-4.

The specific soil sampling protocol is as follows:

1. Boring locations will be staked and then approved by representatives of EKCO.

2. Boreholes will be drilled using a hollow-stem auger drilling rig.

3. Soil samples will be continuously collected from the boreholes. These subsurface samples will be obtained with a 2-foot long split-spoon sampler driven in advance of the bottom of the auger hole, according to the ASTM (D-1586) Standard Penetration Test, to the top of the water table.

4. A detailed drilling log and record of all samples will be maintained by the field geologist/soil scientist. Each split-spoon barrel will be decontaminated between samples according to specifications discussed in this section. Extraneous sample material and drilling cuttings will be containerized and disposed of properly.

5. The boring holes will be backfilled immediately after sampling.

6. One discrete sample will be collected for chemical analysis from each interval of 0 to 2 feet, 4 to 6 feet, and 10 to 12 feet, or from the intervals that the field geologist/soil scientist deems most likely to have contamination.

7. One sample for every 20 collected for analysis will have a duplicate for quality control. This is discussed in more detail later in this section.

The actual steps to be followed while collecting the samples are as follows:

a. Record split-spoon depth, blow count, and driller's comments in field logs.

b. If samples for chemical analysis are required, as outlined above, the sampler will immediately transfer selected samples into prepared appropriate size jars. The outside portion of the sample will be scrapped away and discarded. An aliquot should be left in the spoon for later description. See this section for sample container and preservation requirements.

c. Examine and record in the field logbook the descriptions of the split-spoon sample, including sample recovery, color, grain size, distribution, plasticity, and moisture content. Organic vapor detector readings will also be recorded. These data will be transferred to a boring log form (see Figure 6-4).

d. Close and label sample bottles and record all information in field notebooks (see Section 7).

e. Decontaminate the split-spoon according to the methods specified in this section.

f. Prepare samples for shipping as environmental samples. See Section 7 for sample packaging and shipment.

6.1.4 <u>Surveying</u>

The general site plan will be updated for the EKCO site. Additional vertical and horizontal locations of new monitor wells will be surveyed and added to the existing survey database. Top of casing elevations will be surveyed to the nearest 0.01 foot relative to mean sea level (MSL). Horizontal

DRILLING LOG

WELL NUMBER: ____________ OWNER: ____________

LOCATION: ____________ ADDRESS: ____________

____________ ____________

____________ TOTAL DEPTH ____________

SURFACE ELEVATION: ____________ WATER LEVEL: ____________

DRILLING COMPANY: ____________ DRILLING METHOD: ____________ DATE DRILLED: ____________

DRILLER: ____________ HELPER: ____________

LOG BY: ____________

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)

* A.S.T.M. D1586

SHEET ____ OF ____

FIGURE 6-4 SOIL BORING LOG FORM

locations of wells and borings will be determined to the nearest foot based upon direct measurements from buildings from appropriate benchmarks.

6.1.5 Water Level Data Collection

The tops of the inside well casings of all monitor wells will be surveyed for elevation to the nearest 0.01 foot. The wells will be horizontally located to an accuracy of 1 foot and will be located on the site maps to be prepared for this project.

Groundwater level measurements will be taken using an electric water level probe in all wells prior to sampling. Measurements will be taken from the surveyed reference point marked on the top of the low-carbon steel risers. These data will determine the amount of water to be evacuated from each well prior to sampling. Water level measurements will be taken three times per well or until measurements are within ±0.01 foot. Measurements will be recorded in the field notebook and on field sampling sheets.

6.1.6 Field Analytical Procedures

As part of the analytical protocol for all samples, several parameters will be tested in the field. All liquid samples will be tested for temperature, pH, and specific conductance (SC). At each sampling location a sample aliquot will be collected in a clean, 8-ounce jar for the purpose of field testing. The following subsections describe the procedures for analysis of field parameters.

6.1.6.1 pH Measurement

The pH of all liquid samples will be measured using a Fisher Model No. 107 portable water pH meter (or similar). Before analyzing a sample, the pH meter will be calibrated and will be checked against standard buffer solutions. The probe will then be rinsed with distilled water and placed in the sample to be tested. One minute will be allowed for the meter to stabilize, and the reading will then be recorded in the field logbook. After the reading is taken, the probe will be rinsed with distilled water and placed in pH 7.0 buffer solution until its next use.

6.1.6.2 Specific Conductance and Temperature Measurement

The specific conductance and temperature of all liquid samples will be taken with a YSI Model 33 meter (or similar). The probe will be rinsed with distilled water in between samples. The temperature will be taken with the knob set on "temperature" and the specific conductance measured using the appropriate range of the "conductance" setting. One minute should be allowed for the reading to stabilize prior to recording the measurement in the field logbook. When not in use, the probe will be placed in a jar of distilled water.

6.1.7 Aquifer Testing Procedure

The specific protocol for the pumping tests is as follows:

1. Open well caps and monitor downhole and ambient air quality utilizing monitoring equipment. Record information in field notebook.

2. Measure and record depth to water from the top of the casing in all observation wells to be tested and also in the pumping well. Record as static pumping level (pretest level) in the field notebook.

3. Protect the transducer cables by taping the casing of the observation wells and pumping well with duct tape to cover the top edge.

4. Clean each transducer by sequentially rinsing the probe and attached line with tap water, Alconox in tap water, and distilled water.

5. Lower the transducers into the observation wells and pumping well to a depth of approximately 10 feet below the top of the static pumping level, calibrate them according to manufacturer's directions, and secure the transducer cable with duct tape.

6. Connect the data loggers (SE-2000 or equivalent) to the transducers. The data loggers serve to automatically record water level fluctuations in each of the monitor wells with time.

7. Activate the data loggers at least 12 hours before the start of the pumping test to establish background water level conditions. Record the water levels approximately every 30 minutes.

8. Initiate pumping; collect water-level measurements at the pumping well and observation wells at the following preselected time intervals:

Time Since Pumping Started (or Stopped) in Minutes	Time Interval Between Measurements in Minutes
0-10	.01-.5
10-15	1
15-60	5
60-termination of test	30

9. Closely monitor the pumping rate throughout the test. Adjustments will be made to the pump, as necessary, in order to maintain a constant pumping rate.

10. Continue constant rate pumping for approximately 8 hours.

11. Collect water level recovery data following the same preselected measurement intervals as during the pumping period. Drawdown will be monitored for a period of 4 hours, or until water levels have returned to near pretest levels, whichever comes first.

12. After the test, but before the data loggers are stopped, generate a hard copy of the data readings on the field printer.

13. Remove the transducers and the pump from the wells and decontaminate.

14. Replace and lock the well caps.

6.1.8 Straddle Packer Testing Procedure

The specific protocol for the straddle packer tests is as follows:

1. Decontaminate the packers and all downhole equipment following procedures presented in the QAPP (QAPP Subsection 6.2.1.1).

2. Prior to testing each zone, obtain static water levels and calibrate the pressure transducers to these static levels (T.O.C.).

3. Inflate the packer(s) and allow each isolated portion of the borehole to stabilize. Double-check each pressure transducer and record the head values above, between, and below the packers.

4. Begin pumping of the test zone. Maintain a constant pump rate that will adequately stress the test zone (without dewatering the zone), and record changes in head in the test zone and in the isolated borehole above and below the packers. The objective is to obtain a stable drawdown (± 0.5 ft) that can be maintained over a 30-minute period with constant rate pumping. Specific capacity values will be estimated by dividing pumping rates by the indicated drawdowns (gpm/ft).

5. Obtain analytical samples once a stable drawdown has been obtained and general water quality parameters have stabilized, and again just prior to termination of pumping. At least five test interval volumes should be pumped between each sample collection.

6. Stop the pumping phase of the test and close the flow control valve to prevent water in the purge line from reversing back down the hole. Monitor the recovery of head values until at least 90 percent recovery is obtained.

7. End the test and deflate the packers. The holes will be tested from bottom to top.

6.2 FIELD ACTIVITIES

6.2.1 Decontamination

All material and equipment will arrive onsite in clean condition. Recommended procedures for equipment decontamination, described in the subsections below, will be followed where applicable.

6.2.1.1 Drilling, Soil Sampling, and Monitor Well Installation Equipment Decontamination

Prior to the start of drilling, all drill rods, augers, bits, and split-spoon samplers will be steam-cleaned at an area set up onsite for this purpose. The decontamination will be performed by the drilling subcontractor to the satisfaction of the site geologist and will be documented in the field notebook.

Augers, tools, drill rods, casings, and screens will be inspected to ensure that residue such as muds and machine oils are removed. Similar decontamination procedures will be implemented between each boring to prevent cross-contamination and to ensure the integrity of soil samples. All equipment will also be decontaminated prior to removal from the facility.

6.2.1.2 Well Development Equipment Decontamination

Submersible pumps and equipment used for well development will be decontaminated between wells. Pumps will be decontaminated by submerging the pump intake or downhole portions in a washing solution (laboratory-grade detergent), then in clean potable water, and then pumping the solutions through the pump and line.

6.2.1.3 Water and Soil Sampling Equipment Decontamination

Bailers used for water sampling, as well as other miscellaneous sampling equipment (split-spoons, buckets, sieves), will be decontaminated between sampling points. Pumps used for well purging will be decontaminated by submerging the pump intake first in a washing solution (laboratory-grade detergent), then in clean potable water, and then pumping these solutions through the pump system until the discharge is free of detergent.

The procedure for decontaminating sampling equipment between sampling points and for precleaning dedicated sampling equipment is as follows:

- Place dirty equipment, (e.g., bailers, pumps, buckets, etc.) on a plastic ground sheet at the head of the "decontamination line."
- Rinse equipment in a tub of potable water to remove surface dirt and mud, if necessary.
- Scrub equipment with a bristle brush in a basin filled with laboratory-grade detergent and potable water.
- Rinse off soap in a tub of potable water.
- Rinse with reagent-grade methanol.
- Allow equipment to dry.
- Final rinse with distilled/deionized water.
- Allow equipment to dry before use.
- Wrap equipment in aluminum foil to protect from contamination, where appropriate.

6.2.2 Sample Container and Preservation Requirements

All samples submitted for analysis on this project will be collected by WESTON personnel. Sampling containers and preservatives will be provided on request by WESTON's Analytics Division. The specific requirements for sample containers, preservatives, and analytical holding times are discussed in the following subsections.

6.2.2.1 Sample Containers

All containers provided by WESTON will be obtained from WESTON's Analytics Division, located in Lionville, Pennsylvania. The containers provided are those described in 40

CFR Part 136, No. 209, 26 October 1984. These containers are cleaned in accordance with EPA protocols. Each lot of these containers is analyzed in accordance with quality control requirements and is not shipped unless the QC requirements are met. The types of containers that will be provided for each analyte are listed in Table 6-1, along with the holding times and preservatives required for each analysis.

All sample containers provided by WESTON will be shipped with chain-of-custody records. These chain-of-custody records will be completed by the field sampling personnel and shipped with the samples.

6.2.2.2 <u>Sample Preservation</u>

The preservatives required for all analyses will be provided by WESTON with the sample containers. The required preservation methods for target analyses are listed in Table 6-1.

6.2.2.3 <u>Holding Times</u>

The holding times for all required analyses are measured from time of sample collection and are given in Table 6-1. Holding times for analytes not listed in Table 6-1 will be those given in 40 CFR part 136, No. 209, 26 October 1984.

Upon sample receipt at the WESTON laboratory, all sample collection dates are noted by the sample custodian. The required date for completion of analysis (or extraction) is noted and is keyed to the holding time. All analyses that have holding times of 48 hours or less are identified by the sample custodian, and the appropriate Laboratory Section Manager and analyst are notified that the samples are in the laboratory. A Laboratory Project Manager has been assigned and will be responsible for ensuring proper execution of all required analyses.

Table 6-1

Sample Containers, Sample Volumes, Preservation, and Holding Times

Aqueous Samples

Analyte	Container	Volume	Preservation	Maximum Holding Time[a]
Volatile Organics	G, w/teflon-lined silicone rubber septum	2x40 mL	Cool, 4°C	14 days
Metals	P, teflon-lined cap	1 L	Field - filter groundwater only HNO_3 pH<2 Cool, 4°C	180 days[b]

Soil Samples

Analyte	Container	Volume	Preservation	Maximum Holding Time[a]
Volatile Organics	G, w/teflon-lined silicone rubber septum	2x40 mL	Cool, 4°C	14 days

G = Glass.
P = Plastic.
[a]This is the maximum holding time from date of collection.
[b]Mercury holding time is 28 days.

SECTION 7

SAMPLE IDENTIFICATION, DOCUMENTATION, AND CUSTODY

7.1 SAMPLE IDENTIFICATION AND DOCUMENTATION

Each sample container will be labeled with the following information:

- Sample identification code specified in Subsection 7.2.
- Date/time of collection.
- Preservative.
- Analysis requested.
- Any special information, including potential level of contamination.

After sample collection and before proceeding to the next sampling point, the samplers will complete the following procedures:

- Enter the sample into the chain-of-custody record per Subsection 7.3.
- Apply signed custody seals on opposite sides of the container lid.

A bound field notebook will be maintained by the Field Team Leader at the site to record daily activities, including sample collection and tracking information. Entries will be made in waterproof ink. A separate entry will be made for each sample collected. Entries will include at least the following information:

- Sample identification code.
- Sample location and depth.
- Date and time of collection.

- Sample container/preservative (i.e., cool at 4°C).
- Analysis requested (i.e., VOA).
- Sampling personnel.
- Comments and other relevant observations, such as sampling technique and any modifications to the sampling procedure, color, odor, texture, and other sample characteristics.

7.2 SAMPLE IDENTIFICATION CODE

A unique sample code will be assigned to each sample collected. This will consist of a character code that describes the sample type and location. The sample location is indicated by two characters and a number that are identified as one of the following:

- Subsurface soil samples.
- Sediment samples.
- Groundwater samples.
- Surface water samples.

The number indicates which sampling location was sampled. Example sample type and location designations are presented in Table 7-1.

7.3 CHAIN-OF-CUSTODY PROCEDURES

All WESTON field personnel will follow the U.S. EPA chain-of-custody procedures to ensure preservation of the integrity of all samples. WESTON chain-of-custody records will be used for all sample manifesting on the project. The chain-of-custody records will be initiated by the WESTON laboratory at the time of sample bottle preparation and will follow each bottle through the sequence from bottle preparation through completion of chemical analysis. A copy of this form is included as Figure 7-1.

Table 7-1

Example Sample Identification Codes

Sample Type	Sample Location Identifiers	Sample Type Identifier	Additional Sample Identifier
Subsurface Soils	SB-16 to SB-28	SS	Split-Spoon Sample Interval (i.e.,1 to 3 ft)
Groundwater	Well Designation R1 to R5 I-1 to I-15 L-1 to L-5 S-1 to S-12	GW	Date of Sampling Event (i.e., 9/1/88)

Notes:

1. Quality control samples will be identified by the addition of the following identifiers, as required:
   - MS - Matrix Spike
   - MSD - Matrix Spike/Duplicate Spike
   - FB - Field Blank
   - TB - Trip Blank
   - Dup - Duplicate

2. Example: A subsurface soil sample taken from SB-1 at the 1 to 3-foot interval will be designated as SB-1-SS-1-3, or a groundwater duplicate sample taken on 12 October 1988 from L-1 will be designated as L-1-GW-10/12/88.

WESTON

Custody Transfer Record/Lab Work Request

Received By ____________ Client ____________ RFW Contact ____________

Date ____________ Client Contact ____________ Date Due ____________

Assigned to ____________ Phone ____________ Project Number ____________

SAMPLE IDENTIFICATION **ANALYSES REQUESTED**

Sample No.	Client ID No.	Description	Matrix	Date Collected	Container/Preservative								

Matrix:
S- Soil **DS-** Drum Solids
W- Water **DL-** Drum Liquids
O- Oil **X-** Other

Special Instructions:

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time

FIGURE 7-1 CHAIN-OF-CUSTODY FORM

Collected samples will be under lock and key or under visual control at all times until their shipment to the laboratory. WESTON field samplers will act as sample custodians and document control officers to monitor the location of collected samples and to record vital sample information in field log-books.

Each sample will receive a unique WESTON sample number at the laboratory and will be logged into the laboratory computer. The sample will be assigned to an analysis lot after it is logged in the computer system. A chain-of-custody form will accompany all samples throughout sample movement in the laboratory. Every person handling a sample will note the location change, time, date, and reason for movement.

7.4 QUALITY CONTROL SAMPLES

The reliability and credibility of analytical laboratory results is established by QC samples such as the inclusion of scheduled replicate analyses, analysis of standard or spiked samples, and the analysis of split samples. Section 11 describes in greater detail the Laboratory Quality Assurance Program.

Field QC samples will consist of replicate soil and water samples, field blank samples (equipment decontamination rinsate), and trip blank samples. Replicate, field, and trip blank samples will be analyzed for VOAs. Replicates will be collected at a minimum frequency of one per every 20 soil or water samples collected. The replicates or duplicates will be analyzed for the same parameters as those analyzed in the samples of the media.

A field blank begins with a group of laboratory-cleaned sample containers. The containers are transported empty into the field and are used in collecting "rinse water" obtained by pouring laboratory demonstrated analyte-free (HPLC grade) water over the equipment used to receive the various types of samples. Field blanks will be analyzed for the same parameters as the samples obtained with the equipment from which the blank was collected. One field blank will be collected for each 20 samples.

Trip blanks will be provided by the laboratory and will consist of two 40-mL vials with septum caps containing deionized water. The trip blanks will be capped in the laboratory and will remain capped until returned to the laboratory with the field samples. The trip blanks, to be analyzed for VOAs, will be handled and transported in the same manner as field samples.

7.5 SAMPLE PACKAGING AND SHIPMENT

All samples shipped to WESTON's Analytics Division will be packaged and shipped as environmental samples. Sample packaging procedures will comply with all U.S. Department of Transportation (DOT) requirements for shipment of environmental samples as follows:

- The lid of each labeled jar will be secured with a strip of custody tape.
- Individual sample jars will then be sealed in Ziploc plastic bags and placed in coolers.
- Vermiculite will be placed around the bags in the cooler. Ice will be placed in the cooler.
- One chain-of-custody form will be completed for each cooler, placed in a large Ziploc bag, and taped to the inside lid of the cooler.
- The cooler will be taped closed and sealed with custody tape on two sides such that opening the cooler will break the custody tape.

- The following labels will be placed on the cooler:
    - Upward-pointing arrow labels on all four sides.
    - "This End Up" on top.

Samples will typically be transported from the field to WESTON's laboratory using an overnight carrier service.

SECTION 8

CALIBRATION PROCEDURES

8.1 FIELD EQUIPMENT CALIBRATION

The reliability and credibility of analytical field measurements will be ensured by calibration of the instrumentation. The following subsections review calibration procedures and frequencies for the following in-field analytical instruments to be used during the investigation:

- HNu Photoionization Analyzer.
- Organic Vapor Analyzer (OVA).
- Specific Conductance Meter/Temperature Probe.
- pH Meter.

The instruments will be calibrated before and after each field use or as otherwise described below. Where necessary, instruments will be calibrated each day during field use. The manufacturer's recommended calibration procedures will be followed.

8.1.1 HNu Photoionization Analyzer

The HNu photoionization analyzer is designed to measure the concentration of trace gases in many industrial or plant atmospheres. The analyzer employs the principle of photoionization for detection. A sensor, consisting of a sealed ultraviolet light source, emits photons having sufficient energy to ionize many trace species, particularly organics. The instrument will be calibrated by following the listed procedures:

1. Insert one end of the T tube into probe. Insert the second end of the probe into calibration gas to the 20 to 200 ppm range. The third end of the probe should have the rotometer (bubble meter) attached.

2. Set the function switch to the 0 to 200 ppm range.

3. Crack the valve on the pressured calibration gas container until a slight flow is indicated on the rotometer. The instrument will draw in the volume required for detection, with the rotometer indicating excess flow.

4. Adjust the span potentiometer so that the instrument is reading the exact value of the calibration gas (calibration gas value is labeled on the cylinder).

5. Turn instrument switch to the standby position and check the electronic zero. Reset zero potentiometer as necessary.

6. Record on the form provided all original and readjusted settings as specified by the form.

7. Next, set the function switch to the 0 to 20 ppm range. Remove the mid-range (20 to 200 ppm) calibration gas cylinder and attach the low-range (0 to 20 ppm) calibration gas cylinder as described above.

8. Do not adjust the span potentiometer. The observed reading should be ±3 ppm of the concentration specified for the low-range calibration gas. If this is not the case, recalibrate the mid-range scale repeating procedures 1 to 7 listed above. If the low-range reading consistently falls outside the recommended tolerance range, the probe light source window likely needs cleaning. When the observed reading is within the required tolerances, the instrument is fully calibrated.

The HNu instrument will be calibrated once per week at a minimum.

8.1.2 Organic Vapor Analyzer (OVA)

The OVA is capable of detecting nearly all organic compounds. The instrument is factory calibrated to a methane-in-air standard, but it can be easily calibrated to any of a variety of compounds for precise analyses.

A "Gas Select" control on the instrument panel is used to set the electronic gain to a particular organic compound. Internal electronic adjustments are provided to calibrate and align the electronic circuits. There are four adjustments on the electronics board, but one adjustment potentiometer, R-38, is used to set the power supply voltage and has a one-time factory adjustment. The other three adjustments, R-31, R-32, and R-33, are used for setting the electronic amplifier gain for each of the three calibration ranges. The instrument must be removed from its case to access these adjustments.

To calibrate the OVA to methane, follow the procedures for gain adjustment and bias adjustment.

Gain Adjustment

1. Turn on instrument. Set "Calibrate" switch to x10 and "Gas Select" control to 300.

2. Use the "Calibrate Adjust" knob to adjust the meter reading to zero.

3. Introduce a methane sample of a known concentration (near 100 ppm) and adjust trimpot R-32 on the circuit board so that the meter reads the concentration as equivalent to that of the known sample. This sets the instrument gain for methane, with the gain adjustment on the panel ("Gas Select" knob) set at a reference of 300.

4. Turn off the H_2 "Supply Valve" to put out the flame.

Bias Adjustment

5. Leave the "Calibrate" switch on x10 position and use the "Calibrate Adjust" knob to adjust the meter reading to 4 ppm.

6. Turn the "Calibrate" switch to x1. Using trimpot R-31 on the circuit board, adjust the meter reading to 4 ppm.

7. Set the "Calibrate" switch to x10 again and use the "Calibrate Adjust" knob to set the meter reading to 40 ppm.

8. Move the "Calibrate" switch to x100 position and use trimpot R-33 on the circuit board to adjust the meter to 40 ppm.

9. Set the "Calibrate" switch to x10 position and use the "Calibrate Adjust" knob to adjust the meter to zero.

The unit is now balanced from range to range, calibrated to methane, and ready for use.

The OVA instrument will be calibrated once per week at a minimum.

8.1.3 Specific Conductance Meter/Temperature Probe

The YSI Model 33, or equivalent, is a portable, battery-operated, transistorized instrument used to measure salinity, specific conductance, and temperature in surface water, groundwater, and wastewater systems. The meter is calibrated daily or each time the meter is turned on (if more than once per day) by turning the MODE control to REDLINE and adjusting the REDLINE control so that the indicator lines up with the redline on the meter face.

8.1.4 pH Meter

The Fisher Model No. 107 pH meter, or equivalent, is a portable pH monitoring instrument for determining pH in surface and groundwaters, waste systems, and other water quality applications.

The instrument requires field calibration daily or each time the meter is turned on (if more than once per day). Distilled water and buffer solutions (pH 7 and pH 4) are required for field calibration. All solutions must be at the same temperature to reduce meter stabilization time and to maintain accuracy. The instrument is calibrated as follows:

1. Rinse the electrode in distilled water.
2. Place the electrode in the pH 7 buffer solution and allow the meter reading to stabilize.
3. Adjust the control using the knob on the front panel of the instrument until the meter reads pH 7.
4. Rinse the electrode in distilled water.
5. Place the electrode in pH 4 solution and allow the meter readout to stabilize.
6. Adjust the control knob until the meter reads the correct value of the pH 4 solution.
7. Rinse probe in distilled water.
8. Repeat steps 2 through 7.
9. Record results in logbook.

SECTION 9

ANALYTICAL PROGRAM

All analytical work performed in the assessment of groundwater and soil contamination for the EKCO facility will be performed by WESTON's Analytics Division using EPA-approved methods. Analytical methods will be those specified in SW846, except for specific samples, which will be analyzed using modified EPA Method 524 for VOAs to acquire lower quantification limits. EPA Method 524 will be modified appropriately in order to quantify the following compounds:

- Acetone.
- Carbon Disulfide.
- Trans-1,2-Dichloroethene.
- Vinyl Acetate.
- 2-Butanone.
- 2-Hexanone.
- 4-Methyl-2-Pentanone.
- 2-Chloroethylvinylether.

Quality assurance and documentation procedures in accordance with CLP guidelines will be performed on an "as needed" basis.

Samples will be analyzed for the volatile organic compounds and metals as specified in Table 9-1, Table 9-2, and Table 9-3, as required by the specified analytical method with the corresponding quantification/detection limits. Groundwater samples will be analyzed for the specified volatile organics. Subsurface soil samples will be analyzed for the same volatile organics. Three samples will be taken per soil boring, and all will be taken above the water table. Table 9-4 summarizes the groundwater assessment/analyses program at EKCO. A detailed discussion of analytical methods, objectives, and data reporting for each environmental media of concern is given in the following subsections.

WESTON

Table 9-1

Volatile Organic Constituents and Detection Limits
for EPA Method 8240[a]

Compound	CAS Number	Detection Limits[b] Low Water (ug/L)	Low Soil/Sediment (ug/kg)
Volatiles			
1. Chloromethane	74-87-3	10	10
2. Bromomethane	74-83-9	10	10
3. Vinyl Chloride	75-01-4	10	10
4. Chloroethane	75-00-3	10	10
5. Methylene Chloride	75-09-2	5	5
6. Acetone	67-64-1	10	10
7. Carbon Disulfide	75-15-0	5	5
8. 1,1-Dichloroethene	75-35-4	5	5
9. 1,1-Dichloroethane	75-35-3	5	5
10. trans-1,2-Dichloroethane	156-60-5	5	5
11. Chloroform	67-66-3	5	5
12. 1,2-Dichloroethane	107-06-2	5	5
13. 2-Butanone	78-93-3	10	10
14. 1,1,1-Trichloroethane	71-55-6	5	5
15. Carbon Tetrachloride	56-23-5	5	5
16. Vinyl Acetate	108-05-4	10	10
17. Bromodichloromethane	75-27-4	5	5
18. 1,1,2,2-Tetrachloroethane	79-34-5	5	5
19. 1,2-Dichloropropane	78-87-5	5	5
20. trans-1,3-Dichloropropane	10061-02-6	5	5
21. Trichloroethene	79-01-6	5	5
22. Dibromochloromethane	124-48-1	5	5
23. 1,1,2-Trichloroethane	79-00-5	5	5
24. Benzene	71-43-2	5	5
25. cis-1,3-Dichloropropane	10061-01-5	5	5
26. 2-Chloroethyl Vinyl Ether	110-75-8	10	10
27. Bromoform	75-25-2	5	5
28. 2-Hexanone	591-78-6	10	10
29. 4-Methyl-2-pentanone	108-10-1	10	10
30. Tetrachloroethene	127-18-4	5	5

Table 9-1

Volatile Organic Constituents and Detection Limits for EPA Method 8240[a] (continued)

	Compound	CAS Number	Detection Limits[b] Low Water (ug/L)	Low Soil/Sediment (ug/kg)
31.	Toluene	108-88-3	5	5
32.	Chlorobenzene	108-90-7	5	5
33.	Ethyl Benzene	100-41-4	5	5
34.	Styrene	100-42-5	5	5
35.	Total Xylenes	100-43-5	5	5

[a]Detection limits listed for soil/sediment are based on wet weight. The detection limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, will be higher.

[b]Specific detection limits are highly matrix-dependent. The detection limits listed herein are provided for guidance and may not always be achievable.

Table 9-2

Standard Analytes and Minimum Detection Limits (MDLs) for EPA Method 524

Analyte	Retention Time (minutes) Column[a]	MDL (ug/L)
Chloromethane	0.97	0.41
Vinyl Chloride	1.04	0.23
Bromomethane	1.29	0.27
Chloroethane	1.45	0.14
1,1-Dichloroethene	2.33	0.26
1,2-Dichloroethene	3.54	0.17
Methylene Chloride	2.66	0.5
1,1-Dichloroethane	4.03	0.17
Chloroform	5.55	0.14
1,1,1-Trichloroethane	6.76	0.5
1,2-Dichloroethane	7.00	0.1
Carbon Tetrachloride	7.41	0.08
Benzene	7.41	0.07
1,2-Dichloropropane	8.94	0.24
Trichloroethene	9.02	0.27
Bromodichloromethane	9.34	0.52
Toluene	11.51	0.30
1,1,2-Trichloroethane	11.99	0.20
1,3-Dichloropropane	12.48	0.23
Dibromochloromethane	12.80	0.18
Tetrachloroethene	13.20	0.19
Chlorobenzene	14.33	0.18
Ethylbenzene	14.73	0.19
p-Xylene	15.30	0.19
m-Xylene	15.30	0.19
Bromoform	15.70	0.15
o-Xylene	15.78	0.16
Styrene	15.78	0.18
1,1,2,2-Tetrachloroethane	15.78	0.23
Internal Standard		
Fluorobenzene	8.81	6.45

[a]Column - 30-meter x 0.32-mm ID DB-5 capillary with um film thickness.

Table 9-2A

Additional Analytes and Minimum Detection Limits (MDLs) for Modified EPA Method 524

Analyte	MDL (ug/L)
2-Butanone	1.0
Acetone	1.0
Carbon Disulfide	0.5
4-Methyl-2-Pentanone	1.0
2-Chloroethylvinylether	1.0
Vinyl Acetate	1.0
2-Hexanone	1.0

Table 9-3

Inorganic Constituents and Detection Limits

Element	Detection Level Water (ug/L)	Soil (mg/kg)
Aluminum	200	40.0
Antimony	60	12.0
Arsenic	10	2.0
Barium	200	40.0
Beryllium	5	1.0
Cadmium	5	1.0
Calcium	5,000	1,000
Chromium	10	2.0
Cobalt	50	10.0
Copper	25	5.0
Iron	100	20.0
Lead	5	1.0
Magnesium	5,000	1,000
Manganese	15	3.0
Mercury	0.2	0.2 (ug/L)
Nickel	40	8.0
Potassium	5,000	1,000
Selenium	5	1.0
Silver	10	2.0
Sodium	5,000	1,000
Thallium	10	2.0
Vanadium	50	10.0
Zinc	20	4.0
Cyanide	10	1.0

Table 9-4

Data Objectives
EKCO Housewares, Inc.

Matrix	Parameters	Data Objectives	Lab	Methods	Data Deliverable Package
Groundwater					
R1 to R-3, R-5, W-1, W-2, W-10, L-5, I-5 to I-8, D-4-30, I-2	Volatile organics	Assessment of horizontal and vertical extent of contaminant migration	WESTON Analytics in all cases	8240, 6000/7000	WESTON Level I
I-8, R-4, P-3, I-4	Volatile organics	Assessment of horizontal and vertical extent of contaminant migration	WESTON Analytics in all cases	524, 6000/7000	WESTON Level III
I-9 to I-16, S-4, S-11, S-12, R-7, R-10	Volatile organics and metals	Assessment of horizontal and vertical extent of contaminant migration	WESTON Analytics in all cases	524, 6000/7000	WESTON Level III
Soils	Volatile organics	Quantification of VOC levels in subsurface soils	WESTON Analytics in all cases	8240, 6000/7000	WESTON Level I

Note: WESTON Level III is full CLP documentation and WESTON Level I is the standard commercial documentation package.

9.1 COMMON LABORATORY CONTAMINANTS

Certain volatile organic compounds such as methylene chloride, acetone, 2-butanone, and toluene are commonly detected as laboratory contaminants. In order to ensure that the data reported are not biased by potential laboratory contamination, certain quality assurance procedures, including reagent blank analysis, will be taken.

For the analysis of volatile compounds, a reagent blank analysis will be performed every 12 hours, once per case, or with every 20 samples of similar concentrations of target compounds. Blanks must contain less than five times the Practical Quantification Limits (PQLs) of methylene chloride, acetone, 2-butanone, and toluene for the reported data to be considered valid.

9.2 GROUNDWATER ANALYSIS

Groundwater quality will be analyzed for volatile organic compounds (Tables 9-1, and 9-2) and inorganic constituents (specified in Table 9-3) as stated in Table 9-4. The analytical methods are those specified in EPA SW846, with the exception of EPA Method 524 for volatile organic compounds, which is an analytical method approved by EPA to ensure safe drinking water, as presented in Table 9-4. EPA Method 524 will be used for offsite or perimeter wells to obtain the lower quantification limits of this method at those locations.

Two levels of data documentation will be obtained for these analyses. WESTON Level I (standard commercial) data packages will be provided for the majority of groundwater quality analyses. However, WESTON Level III (full CLP) data packages will be provided for offsite or perimeter wells that are felt to be critical data points in the assessment. These wells are specified in Table 9-4.

9.3 SOIL ANALYSIS

Selected borings will be sampled at 0 to 2 feet, 4 to 6 feet, and 10 to 12 feet below ground level or at the discretion of the onsite geologist. Factors influencing selection of boring material for analysis include the presence of characteristic vapors or discoloration not indigenous to the soil type.

The boring material will be analyzed for volatile organics. Volatile organic compounds will be analyzed using EPA Method 8240 as specified in Table 9-1.

9.4 SAMPLE ANALYSIS PROGRAM

Table 9-5 summarizes the number of sample containers that need to be filled for each sample matrix and analysis.

Table 9-5

Approximate Totals for Number of Container Samples

Environmental Media	Samples for Each Location	Containers Per Location
Groundwater	1	2 VOC 1 Metal*
Soil Boring Samples	2	2 VOC

*As per Table 9-4.

SECTION 10

DATA MANAGEMENT

10.1 FIELD AND TECHNICAL DATA

The field and technical (nonlaboratory) data that will be collected can generally be characterized as either "objective" or "subjective" data.

Objective data include all direct measurements of field data such as field screening/analytical parameters and water level measurements. Subjective data include descriptions and observations. Soil boring and well logs include both types of data in that the data recorded in the field are descriptive, but can be reduced using a standardized lithologic coding system.

10.1.1 Field Logs

All data collection activities performed at a site will be documented either in a field notebook or on appropriate forms. Entries will be as detailed and descriptive as possible so that a particular situation can be recalled without reliance on the collector's memory. All field log entries should be dated. Field notebooks will be bound books and will be assigned to individual field personnel for the duration of their stay in the field. All field log forms will be kept in ring binders assigned to individual field personnel.

The cover of each notebook or ring binder will contain the following information:

- Person to whom the book is assigned.
- Project name.
- Start date.
- End date.

10.1.2 Field Data Reduction

As described in Subsection 6.1, all field data will be recorded by field personnel in bound field notebooks and on the appropriate forms in ring binders. For example, during drilling activities the field team member supervising a rig will keep a chronologic log of drilling activities, a vertical descriptive log of lithologies encountered, other pertinent drilling information (staining, odors, field screening, atmospheric measurements, water levels, geotechnical data), and a labor and materials accounting in his/her bound notebook. Upon completion of each test boring or monitor well, a form will be completed that will include lithologic codes along with descriptive data.

After checking the data in the field notes and forms (see Field Data Validation in Subsection 10.1.3 below), the Laboratory Data Administrator will reduce the data to tabular form, wherever possible, by entering it in data files. Where appropriate, the data files will be set up for direct input into the database. For example, the form for a test boring or well log will be checked against the field notes and then keypunched directly to the database. Other objective data may be set up in spreadsheet-type tabular files (e.g., water level data). Subjective data will be filed as hard copies for later review by the Technical Manager and for incorporation into technical reports as appropriate.

10.1.3 Field Data Validation

Validation of objective field and technical data will be performed at two different levels. On the first level, data will be validated at the time of collection by following the standard procedures and QC checks (e.g., triplicate measurements) specified in Section 7. At the second level, data will be validated by the Data Administrator, who will review it to ensure that the correct codes and units have been included.

After data reduction into tables or arrays, the data will be reviewed for anomalous values. Any inconsistencies of anomalies discovered by the Data Administrator will be resolved immediately, if possible, by seeking clarification from the field personnel responsible for collecting the data.

Subjective field and technical data will be validated by the Technical Leader, who will review field reports for reasonableness and completeness. In addition, random checks of sampling and field conditions will be made by the Field Supervisor, who will check recorded data at that time to confirm the recorded observations. Whenever possible, peer review will also be incorporated into the data validation process, particularly for subjective data, in order to maximize consistency between field personnel. For example, during drilling activities the Field Supervisor will schedule periodic reviews of archived lithologic samples to ensure that the appropriate lithologic descriptions and codes are being consistently applied by all field personnel.

10.2 LABORATORY DATA

The laboratory data will include all data generated from laboratory analysis of samples, such as results from physical and chemical testing.

10.2.1 Data Logging

The sample custodian, upon receipt of samples for analysis accompanied by a completed request for analysis and/or chain-of-custody form, will perform the following:

- Verify completeness of submitted documents, including the chain-of-custody forms.
- Log-in samples, assign unique lot log numbers, and attach the numbers to the sample container(s).

- Open the project file and enter data on the laboratory computer.
- Assign priority and hazard rating criteria.
- Store samples in refrigerated sample bank.

10.2.2 <u>Data Collection</u>

In addition to the data collected in the field and recorded on the chain-of-custody forms, data describing the processing of samples will be accumulated in the laboratory and recorded in laboratory notebooks. Laboratory notebooks will contain:

- Date of processing.
- Sample numbers.
- Client (optional).
- Analyses or operation performed.
- Calibration data.
- Quality control samples included.
- Concentrations/dilutions required.
- Instrument readings.
- Special observations (optional).
- Analyst's signature.

10.2.3 <u>Laboratory Data Reduction</u>

Data reduction is performed by the individual analysts and consists of calculating concentrations in samples from the raw data obtained from the measuring instruments. The complexity of the data reduction will be dependent on the specific analytical method and the number of discrete operations (extractions, dilutions, and concentrations) involved in obtaining a sample that can be measured.

For those methods using a calibration curve, sample responses will be applied to the linear regression line to obtain an initial raw result, which is then factored into equations to obtain the estimate of the concentration in the original sample. Rounding will not be performed until after the final result is obtained to minimize rounding errors and results will not normally be expressed in more than two significant figures.

Copies of all raw data and the calculations used to generate the final results will be retained on file to allow reconstruction of the data reduction process at a later date.

10.2.4 Laboratory Data Validation

System reviews are performed at all levels. The individual analyst constantly reviews the quality of data through calibration checks, quality control sample results, and performance evaluation samples. These reviews are performed prior to submission to the Laboratory Section Managers or to the Analytical Project Manager.

The Laboratory Section Manager and/or the Analytical Project Manager will review data for the precision, accuracy, and completeness criteria to assess the validity of the measurements. Selected hard copy output of data (chromatograms, spectra, etc.) will be reviewed to ensure that results are correctly interpreted. Unusual or unexpected results will be reviewed and a resolution will be made as to whether the analysis should be repeated. In addition, the Laboratory Project Manager or Laboratory Section Manager will recalculate selected results to verify the calculation procedure.

The final routine review is performed by the Laboratory Manager prior to reporting the results to the client. Nonroutine audits are performed by regulatory agencies and client representatives. The level of detail and the areas of concern during these reviews are dependent on the specific program requirements.

10.2.5 Data Reporting

Reports will contain final results (uncorrected for blanks and recoveries), methods of analysis, levels of detection, surrogate recovery data, and method blanks data. In addition, special analytical problems and/or any modifications of referenced methods will be noted. The number of significant figures reported will be consistent with the limits of uncertainty inherent in the analytical method. Consequently, most analytical results will be reported to no more than two significant figures. Data are normally reported in units commonly used for the analyses performed. Concentrations in liquids are expressed in terms of weight per unit volume (e.g., milligrams per liter). Concentrations in solid or semisolid matrices are expressed in terms of weight per unit weight of sample (e.g., micrograms per gram).

Reported detection limits will be the concentration in the original matrix corresponding to the low-level instrument calibration standard after concentration, dilution, and/or extraction factors are accounted for.

10.2.6 Data Deliverable Package

Upon completion of the data reporting for a batch of samples, a deliverable package will be assembled for EKCO Housewares, Inc., U.S. EPA, and OEPA review. The type and content of each deliverable package will depend on the data objectives from the samples being analyzed. The two different package types being used for this project are summarized below.

10.2.6.1 Level I: Standard Commercial Data Deliverable Package

Level I is the standard commercial data package that includes:

- A cover page describing data qualifiers, sample collection, extraction, and analysis dates, and a description of any technical problems encountered with the analysis.

- Spreadsheet sample data with QC result summaries.

10.2.6.2 Level III: WESTON's Analytics Division

A Level III data deliverable package is the full U.S. EPA CLP data report as described in the U.S. EPA CLP Statement of CLP Work (7/85).

10.3 DATA ARCHIVING

The laboratories will maintain on file all of the raw data, laboratory notebooks, and other documentation pertinent to the work on a given project. This file will be maintained for 6 years, as per the Consent Agreement, from the date of invoice unless a written request is received for an extended retention time.

Data retrieval from archives will be handled in a similar fashion as a request for analysis. Specifically, a written work request to include a quotation must be submitted for retrieval of data. Client confidentiality will be maintained with retrieved data. Consequently, the laboratory will honor only those requests for data authorized by the original client.

10.4 DATA REPORTING

At the conclusion of this study a final report will be prepared. The report will first be submitted as a preliminary draft for regulatory agency review and comment. The report will include discussion of regional and site-specific hydrogeology, well and boring logs, water level data, cross sections, ground-water contour maps, chemical analysis results from soil and water samples, and quality assurance/quality control documentation. Laboratory results will include results from both field and laboratory quality control samples.

SECTION 11

LABORATORY QA/QC CHECKS

The purpose of quality assurance/quality control checks is to produce precise, accurate, and complete data.

11.1 OVERVIEW

Quality assurance checks are usually divided into two groups:

- Internal checks and laboratory methods.
- External checks usually accomplished by multilaboratory evaluation of split samples.

The internal checks described in this section will be employed specifically for this project. Site-specific external quality assurance checks are not planned for use during this project because WESTON has been subjected to periodic external performance audits under the U.S. EPA Contract Laboratory Program. As part of those audits, the laboratory has participated quarterly in the analysis of performance evaluation samples from the U.S. EPA Contract Laboratory Program for organics and inorganics.

11.2 INTERNAL QUALITY ASSURANCE CHECKS

Internal quality assurance procedures are designed to ensure consistency and continuity of data. These procedures include:

- Instrument performance checks.
- Instrument calibration.
- Retrieval of documentation pertaining to instrument standards, samples, and data.

- Documentation of analytical methodology and QC methodology (QC methodology includes spiked samples, duplicate samples, blanks, and check standards for method accuracy and precision).

- Documentation of sample preservation and transport.

Internal quality assurance checks on field activities will be performed by the Field Team Leader. Internal quality assurance checks for laboratory activities will be the responsibility of the Laboratory Manager.

11.3 QUALITY CONTROL SAMPLES

Standard analytical quality control checks to be instituted by field and laboratory personnel include but are not limited to:

- Field Blanks - Samples prepared using analyte-free water supplied by the laboratory (or purchased from commercial sources that certify the quality of the water) by running the water through the decontaminated sampling implements and directly into a prepared sample container. During field sampling a field blank will be collected and analyzed from each group of samples of a similar matrix type for each batch of samples or for each 20 samples received, whichever is more frequent.

- Trip Blanks - Volatile organic samples prepared in the laboratory using analyte-free water. The trip blanks accompany the field samples during transport to the site, during collection, packaging, and transport to the lab, during analysis, and will be contained in the same type of sample container as those used in the current sampling effort. One trip blank sample will be analyzed for each day of sampling.

- Duplicate Samples - Samples collected from the same sampling location at the same time. Soil duplicates will be homogenized (with exception of VOA samples). At least one duplicate sample will be analyzed from each group of samples of a similar matrix type or for each 20 samples received, whichever is more frequent.

- Matrix Spike/Matrix Spike Duplicate - Samples in which compounds are added before extraction and analyses. The recoveries for spiked compounds can be used to accept or reject data. At least one spiked sample analysis will be performed on each group of samples of a similar matrix type and concentration for each batch of samples or for each 20 samples received, whichever is more frequent.

11.4 QUALITY ASSURANCE REPORTS

The Laboratory Quality Assurance Officer will prepare a report detailing the following information:

- Data accuracy.
- Data precision.
- Completeness with respect to planned analyses.
- Results of any performance or systems audits conducted during the project.
- Significant QA problems and recommended solutions.

This information will be made a part of the final report.

Comprehensive QA records will be maintained to provide evidence of the quality assurance activities. Records of the quality assurance program implementation will be written and retained on file. Quality assurance documents will be archived in the project file along with raw data, laboratory notebooks, and other information pertinent to the project.

The retention of quality assurance records is essential to provide support in evidentiary proceedings. The original quality assurance records, including the front pages of the chain-of-custody forms for the EKCO site, will be retained in the project file. Quality assurance evaluations will be performed prior to releasing data for EPA and OEPA review.

The Laboratory Manager will be responsible for ensuring that quality assurance records are properly filed and stored and that they can be readily retrieved.

SECTION 12

PERFORMANCE AND SYSTEM AUDITS

12.1 GENERAL

Independent audits of field sampling, preservation, shipping, and equipment cleaning procedures conducted by EPA or OEPA representatives are anticipated during the course of the project. Audits, if any, will be conducted during actual field operations.

After such an audit has taken place, the EPA or OEPA auditor will be requested to brief the Field Team Leader to discuss any nonconforming actions or procedures observed. Corrective action (if any) that may be taken as a result of the audit will be documented in the project files.

12.2 FIELD AUDITS

An unannounced audit of the ECKO Housewares, Inc. site pertaining to conformance with QA/QC procedures may be performed by designated WESTON personnel. The auditing of field operations is in keeping with WESTON Corporate QA policy and is primarily performed for internal use. The Corporate QA Manager randomly chooses the project to audit. The auditor informs the Project Manager of the audit the day prior to auditing. A written report on the results of this audit (and where necessary, a notice of nonconformance) will be submitted to the following:

- EPA Site Manager.
- OEPA Site Manager.
- Project Manager.
- Field Team Leader.

A nonconformance notice describes any nonconforming conditions and sets a date for response and corrective action. The response is reviewed by the U.S EPA Site Manager and, if satisfactory, is approved in writing.

At the completion of the project, a final quality assurance audit will be performed. A statement will be included in the final report that summarizes any deviations from approved methods and their impact on results. Data completeness, precision, and accuracy will be evaluated to determine sufficiency of the data obtained during the project.

12.3 EXTERNAL AUDITS

Unannounced audits of the field procedures or laboratory may be conducted by EPA or OEPA. Written reports on the results of these audits will be distributed to the same individuals listed in Subsection 12.2. Nonconformances will be addressed in a manner similar to the procedures applicable to field audits.

External performance audits are periodically conducted as requirements for formal laboratory certification programs, such as analyzing public drinking water systems. WESTON does participate in these external audits.

SECTION 13

PREVENTIVE MAINTENANCE

13.1 FIELD EQUIPMENT

An inventory control system governing field equipment and instrumentation will be maintained by the equipment storeroom supervisor as the basis for maintenance and calibration control. The inventory control documentation includes the following:

- Description of instrument.
- Manufacturer, model number, and serial number.
- Identification number.
- Name, address, and telephone number of company that services the instrument or equipment.
- Type of service policy.
- Timing and frequency of routine maintenance, service, and calibration.

13.2 GENERAL EQUIPMENT MAINTENANCE AND REPAIR

Instruments will be maintained in accordance with manufacturer's specifications. More frequent maintenance may be required depending on operational performance. Instrument logs will be maintained to document the date and type of maintenance performed.

Contracts on major instruments with manufacturers and service agencies are used to provide routine preventive maintenance and to ensure rapid response for emergency repair service. Minimal instrument down-time is experienced through the use of these contracts.

13.3 LABORATORY EQUIPMENT

The following instrumentation will be used for chemical analyses:

1. Analysis by gas chromotography of organic compounds consisting of volatiles (VOAs).

2. Analysis by AA and/or ICP of inorganic compounds consisting of metals.

Procedures for maintenance and calibration are in accordance with the manufacturer's specifications and are described in the WESTON Laboratory Quality Assurance Plan (OP 21-20-018). Full manufacturer's service agreements are maintained for all GC, AA, and ICP instrumentation. Typical response to emergency repairs takes place within 24 to 48 hours. Spare parts are retained in the laboratory's inventory for routine repair. Trained service representatives may be consulted or used for more complex repairs.

SECTION 14

FREQUENCY OF INTERNAL QUALITY CONTROL CHECKS

The frequency of quality checks is based on the type of analysis. Regularly scheduled analysis of known duplicates, standards, and spiked samples are a routine aspect of the data reduction, validation, and reporting procedures. Specific frequency criteria for internal quality assurance checks cited below are presented in the WESTON Analytical Laboratory Quality Assurance Plan.

14.1 Gas Chromatography/Mass Spectroscopy (GC/MS)

14.1.1 GC/MS Instrument Performance Documentation

Mass spectrometers are tuned on a daily basis to manufacturer's specifications with FC-43. In addition, once per shift these instruments are tuned with decafluorotriphenylphosphine (DFTPP) or 4-bromo-fluorobenzene (BFB) for semivolatiles or volatiles, respectively. Ion abundances will be within the windows dictated by the specific program requirements. Once an instrument has been tuned, initial calibration curves for analytes (appropriate to the analyses to be performed) are generated for at least five solutions containing known concentrations of authentic standards of compounds of concern. The calibration curve will bracket the anticipated working range of analyses.

Calibration data, to include linearity verification determined by response factor evaluation, will be maintained in the laboratory's permanent records of instrument calibrations.

14.1.2 GC/MS Method Performance Documentation

During each operating shift, a midpoint calibration standard is analyzed to verify that the instrument responses are still within the initial calibration determinations. The calibration check compounds will be those analytes used in the EPA Contract Laboratory Program's multicomponent analyses (e.g., priority pollutants and hazardous substances list), with the exception that benzene is used in place of vinyl chloride (volatiles) and di-n-octyl phthalate is deleted from the semivolatile list.

The response factor drift (% D, i.e., percent difference compared to the average response factor from the initial calibration) will be calculated and recorded. If significant (>30%) response factor drift is observed, appropriate corrective actions will be taken to restore confidence in the instrumental measurements.

All GC/MS analyses will include analysis of a method blank and two spikes (semivolatiles and pesticides/PCBs, as appropriate) in each lot of 20 or fewer samples. The U.S. EPA-CLP matrix spike solutions will be used for both matrix spikes and blank spikes. In addition, appropriate surrogate compounds specified in EPA methods will be spiked into each sample.

Recoveries from method spikes and surrogate compounds are calculated and recorded on control charts to maintain a history of system performance.

A method blank spike duplicate (BSD) sample may be analyzed in place of the matrix spike for analytical lots of less than 10 samples.

Audit samples will be periodically analyzed to compare and verify laboratory performance against standards prepared by outside sources.

14.1.3 GC/MS Detection Limits

The U.S. EPA-CLP contract required quantitation limits (CRQL) are used for reporting GC/MS data (volatiles). These detection limits are compared with laboratory-determined instrument detection limits to ensure that the reported values are attainable. Instrument detection limits are determined from triplicate analysis of target compounds measured at three to five times the CRQL. The calculated instrument detection limit is three times the standard deviation of the measured values.

14.1.4 GC Calibration

Gas chromatographs will be calibrated prior to each day of use. Calibration standard mixtures will be prepared from appropriate reference materials and will contain analytes appropriate for the method of analysis.

Working calibration standards will be prepared fresh daily. The working standards will include a blank and a minimum of five concentrations to cover the anticipated range of measurement. At least one of the calibration standards will be at or below the desired instrument detection limit. The correlation coefficient of the plot of known versus found concentrations (or response) must be at least 0.996 in order to consider the responses linear over a range. If a correlation coefficient of 0.996 cannot be obtained, additional standards must be analyzed to define the calibration curve. A midpoint calibration check standard will be analyzed each shift to confirm the validity of the initial calibration curve. The check standard must be within 20 percent of the initial response curve to demonstrate that the initial calibration curve is still valid.

Calibration data, including the correlation coefficient, will be entered into laboratory notebooks to maintain a permanent record of instrument calibrations.

14.1.5 GC Quality Control

At least one method blank and two method spikes will be included in each laboratory lot of samples, representing a minimun of 5 percent of QC. Lot sizes vary depending on the volume of sample submitted for analysis. Regardless of the matrix being processed, the method spikes and blanks will be in aqueous media. Method spikes will be at a concentration of approximately five times the detection limits.

The method blanks will be examined to determine if contamination is being introduced in the laboratory.

The method spikes will be examined to determine both precision and accuracy. Accuracy will be measured by the percent recovery of the spikes. These recoveries will be plotted on control charts to monitor method accuracy. Precision will be measured by the reproducibility of both method spikes and will be calculated as relative percent difference (% RPD). These percent RPDs will be plotted on control charts to monitor method precision.

14.2 ATOMIC ABSORPTION SPECTROPHOTOMETRY (AA)

Atomic absorption spectrophotometers will be calibrated prior to each day of use.

Calibration standards will be prepared from appropriate reference materials, and working calibration standards will be prepared fresh daily. The working standards will include a blank and a minimum of three concentrations to cover the anticipated range of measurement.

Duplicate injections will be made for each concentration. At least one of the calibration standards will be at or below the desired instrument detection limit. The correlation coefficient of the plot of known versus found concentrations will be at least 0.996 in order to consider the responses linear over a range. If a correlation coefficient of 0.996 cannot be achieved, the instrument will be recalibrated prior to analysis of samples.

Calibration data, including the correlation coefficient, will be entered into laboratory notebooks to maintain a permanent record of instrument calibrations.

14.2.1 AA Method Performance Documentation

At least one method blank and two method blank spikes (laboratory control samples (LCS)) will be included in each laboratory lot of samples. Regardless of the matrix being processed, the LCS and blanks will be in aqueous media. The LCS will be at a concentration of approximately five times the detection limit.

The method blanks will be examined to determine if contamination is being introduced in the laboratory and will be introduced at a frequency of one per analytical lot or five percent of the samples, whichever is more. The LCS will be examined to determine both precision and accuracy. Accuracy will be measured by the percent recovery (percent R) of the spikes. The recovery must be within the range 80 to 120 percent to be considered acceptable, with the exception of antimony and silver due to documented method deficiencies in achieving reliable results. Additionally, the LCS percent R will be plotted on control charts to monitor method performance.

Precision will be measured by the reproducibility of both LCS's and will be calculated as relative percent difference (percent RPD). Results must agree within 20 percent RPD in order to be considered acceptable.

14.2.2 AA Detection Limits

The laboratory routinely reports EPA-CLP contract required quantification limits (CRQLs) for client reports. The CRQLs correspond to the SW-846 6000/7000 series detection limits listed in Table 9-3. These limits are compared with laboratory-determined Instrument Detection limits (IDLs) on a quarterly basis to ensure that the reported values are attainable. IDLs are determined from three nonconsecutive days' analysis of seven consecutive measurements of target compounds at three to five times the IDL. Each day's seven measured values are averaged and the respective standard deviation calculated. Three times the standard deviation of the average of the standard deviations obtained from the 3 days' analysis is defined as the IDL. The IDL must be at or below the CRQLs.

14.3 INDUCTIVELY COUPLED PLASMA SPECTROSCOPY (ICP)

14.3.1 ICP Calibration

The inductively coupled plasma spectrometer will be calibrated prior to each day of use. Calibration standards will be prepared from reliable reference materials and will contain all metals for which analyses are being conducted. Working calibration standards will be prepared fresh daily. The working standards will include a blank and a minimum of five concentrations to cover the anticipated range of measurement. Duplicate readings will be made for each concentration. At least one of the calibration standards will be at or below the desired instrumental detection limit. In order to consider the responses linear, the correlation coefficient of the plot of responses versus concentrations will be at least 0.996. If a correlation coefficient of 0.996 cannot be obtained, the spectrometer will be recalibrated prior to analysis of samples. This calibration will be done quarterly to verify the linear range of the instrument.

Calibration data, including the correlation coefficient, will be entered into laboratory notebooks to maintain a permanent record of instrument calibrations.

On a daily basis, the instrument will be calibrated using a standard at the high end of the calibration range. This standard must not deviate more than ±5 percent from the quarterly established value. The calibration is verified with a midrange calibration check standard that is prepared from a different source than the instrument calibration standard. This standard must not deviate more than ±10 percent from the target value. In addition, a linear range check at approximately two times the detection limit will be analyzed to verify linearity near the detection limit.

14.3.2 <u>ICP Quality Control</u>

At least one method blank and two method blank spikes (laboratory control samples (LCS)) will be included in each laboratory lot of samples. Regardless of the matrix being processed, the LCS's and blanks will be in aqueous media. The LCS will be at a concentration of approximately five times the detection limit. The method blanks will be examined to determine if contamination is being introduced in the laboratory.

The LCS results will be examined to determine both precision and accuracy. Accuracy will be measured by the percent recovery (% R) of the spikes. The recovery must be within the range of 80 to 120 percent to be considered acceptable. Additionally, the LCS % R will be plotted on control charts to monitor method accuracy.

Precision will be measured by the reproductability of both LCS's and will be calculated as relative percent difference (% PRD). Results must agree within 20 percent RPD in order to be considered acceptable.

14.3.3 ICP Detection Limits

The laboratory routinely provides EPA-CLP contract required quantitation limits (CRQLs) for client reports. The CRQLs correspond to the SW-846 6000/7000 series detection limits listed in Table 9-3. These limits are compared with laboratory-determined Instrument Detection Limits (IDLs) on a quarterly basis to ensure that the reported values are attainable. IDLs are determined from 3 nonconsecutive days' analysis of seven consecutive measurements of target compounds at three to five times of IDL. Each day's seven measured values are averaged and the respective standard deviation calculated. Three times the standard deviation of the average of the standard deviations obtained from the 3 days' analysis is defined as the IDL. The IDLs must be at or below the CRQLs.

SECTION 15

CORRECTIVE ACTION

15.1 GENERAL

The Project Manager will ensure that additional work that is dependent on the nonconforming activity is not performed until the nonconformance is corrected.

When a nonconformance or deficiency is identified during a formal EPA or OEPA audit or during a routine WESTON QA inspection, corrective action will be initiated by the Field Team Leader or other appropriate individual (e.g., Laboratory Quality Assurance Manager). The auditor will also be responsible for ensuring corrective actions that adequately address the nonconformance have been taken. A nonconformance report form will be filed for nonlaboratory-related deficiencies.

Technical staff will be responsible for reporting suspected technical nonconformances by initiating a nonconformance report on any issue, deliverable, or document. Project personnel will be responsible for reporting suspected quality assurance nonconformances by initiating a nonconformance report. The technical and/or analytical Project Manager will be responsible for ensuring that corrective actions for nonconformances are implemented by the following:

- Evaluation of reported nonconformances.
- Control of additional work on nonconforming items.
- Determination of disposition or action to be taken.
- Maintenance of a log of nonconformance.
- Review of nonconformance reports.
- Evaluation of disposition or action taken.
- By ensuring conformance.

15.2 LABORATORY ACTIVITIES

15.2.1 Gas Chromatography/Mass Spectrometry

The GC/MS instrumentation will be employed in this project for organic compound analyses. During each shift the analyst will verify that the instrument responses are within the initial calibration. The response factor drift (percent RSD) will be calculated and recorded. If calibration check compound (CCC) and system performance check compound (SPCC) criteria are not met, corrective action will be taken as per the U.S. EPA CLP Statement of Work for Organics Analysis.

15.2.2 AA/ICP Spectroscopy

An inductively coupled plasma (ICP) spectrometer and an AA spectrometer will be employed for the analysis of inorganics (metals). As described in OP 21-20-019, the calibration curve frequency and criteria will be utilized with specified corrective action taken as required. Such corrective action follows the U.S. EPA CLP Statement of Work for Inorganic Analysis.